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DECEMBER

# THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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Continuous Gum—*Howard*
Early Loss of Teeth—*Sippy*
Cavity Preparation—*Byrnes*
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Christmas and the Seals
The Young Practitioner

BUREAU OF CHEMISTRY
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DENTAL HEALTH EDUCATION
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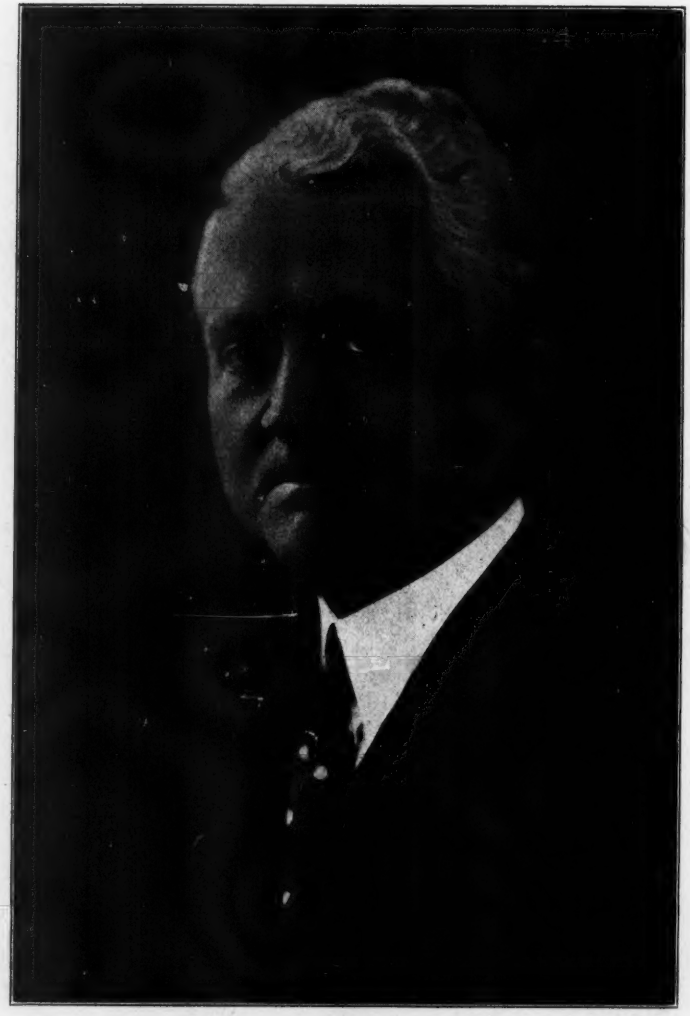

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## Original Communications

# TRIFACIAL NEURALGIA*

By HUGH T. PATRICK, M.D., Chicago, Illinois

TRIFACIAL neuralgia is a disorder or disease of the sensory portion of the fifth cranial nerve. The three sensory divisions of this nerve arise from the ganglion of Gasser, which lies close to or in contact with the pons varolii (v. n. trigeminus; Fig. 1), in a shallow depression on the anterior surface of the petrous portion of the temporal bone. The first division passes forward, a little upward, along the roof of the orbit, to emerge at the supra-orbital notch. The second (middle) division passes forward, through the foramen rotundum, along the floor of the orbit, to emerge at the infra-orbital foramen. The third (inferior maxillary) division passes downward, through the foramen ovale, enters the ramus of the lower jaw and emerges at the mental foramen. (Fig. 2.) The tegumentary distribution is shown in Figures 3, 4 and 5. The three drawings show the differences of opinion of anatomists. It should be noted that all divisions, especially the second and third, begin to send off branches long before they reach the skin. (Fig. 2.) This is most important in relation to the treatment of trifacial neuralgia.

Allow me to make a few statements of fact:

1. The pathology of tic douloureux[1] is unknown. As far as we know, it is not a neuritis. By some the seat of the disease is believed to be in the gasserian ganglion. This never has been proved. No pathologic anatomy has ever been established.

2. The etiology is unknown. The disease is not caused by syphilis nor by

*Read before the Section on Oral Pathology of the Midwinter Clinic of the Chicago Dental Society, Jan. 24, 1928.

1. In this paper, tic douloureux and trifacial neuralgia are interchangeable terms.

any other constitutional disease or infection or intoxication. Nor is it due to local irritation, inflammation or infection. Especially, according to our present knowledge, it is not caused by infection of the teeth or by inflammation in the maxillary antrum or other sinuses; or by infection of the tonsils, or by dental caries. Emphatically is it not due to impaction or noneruption of teeth; nor to the presence of pulp stones. If by some pathologic freak, apical infection or any of these other local dis-

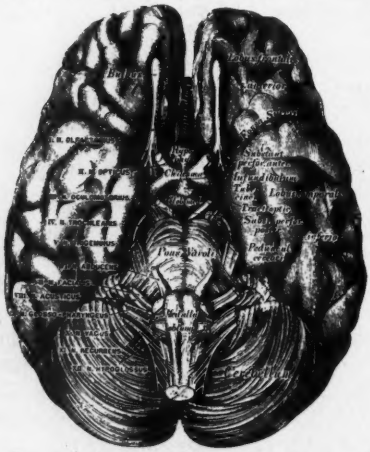

Fig. 1.—Origin of fifth nerve (v. n. trigeminus).

eases does cause trifacial neuralgia, we know that extraction of the teeth, cleaning out sinuses, removal of tonsils, assuredly does not cure it. Nor is the disease a manifestation of senility or presenility.

3. The fifth nerve, if divided anywhere peripherally to the gasserian ganglion, will grow together again, and if the subject has trifacial neuralgia, the pain returns when the nerve has regenerated. Whether this division of the nerve be done with a knife or a chemical, such as alcohol, the result is the same.

Now, presumably, we are ready for the symptomatology and diagnosis.

Most frequently the pain begins in the middle branch; next frequently, in the lower branch; rarely, quite rarely, in the first or supra-orbital branch.

The pain is severe: in a full-fledged case, it is excruciating. A dull ache, a dead pain, a throbbing, a discomfort or pressure or sense of fullness or tension is not tic douloureux.

The pain always is short lived. In the beginning, it nearly always is in-

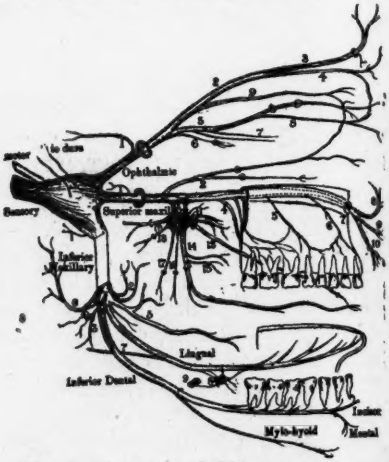


Fig. 2.—Branches of fifth nerve.

stantaneous. "Shoot, stab, jab, flash, dart, knock, zipp, twinge, bing, shock, are words patients have used."[2] Shock of an instantaneous electric current, zig-zag lightning and touching an exposed nerve are comparisons that I have heard. The pain may remain like this for years; one pain in a few days to hundreds in a day. Generally after a few years, rarely after a few months, they become longer, lasting from five to sixty seconds. Pains lasting longer than a

2. Patrick, H. T.: Symptomatology of Trifacial Neuralgia, J.A.M.A., May 16, 1914.

minute are very exceptional. I have timed many hundreds. Once I timed one at fifteen minutes and one at five minutes. These were the longest. But, in a bad case, the separate pains may follow so closely that to the patient they seem continuous.

A practically unique characteristic of trifacial neuralgia is that the pain is started by slight peripheral stimulus in the area of distribution of some branch of the nerve. Touching the face, even touching the moustache, taking a drink

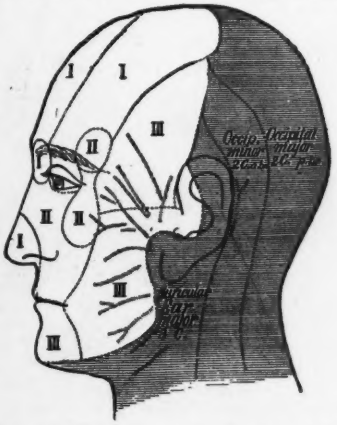


Fig. 3.—Tegumentary distribution of fifth nerve. Figures 4 and 5 are drawings by other authors illustrating distribution of the nerve.

(especially a cold one), biting, talking (movement and touching of lips and tongue), washing the face, brushing the teeth may set the pain going. Inadvertently touching the face at night with bed clothing may do the same. Often, this is described as "tenderness." It is nothing of the sort. In trifacial neuralgia, there is no tenderness. And the celebrated points of Valleix are nonexistent.

These areas from which the pain may be started are sometimes quite restricted and are not necessarily where the pain is felt. Years ago, I called them trigger zones,[2] because veritably they act like triggers. We touch or rub the zone, and off goes the pain.

Just here, it should be noted that, not infrequently, a tooth is a trigger zone; and this tooth may be absolutely sound, just as the upper lip or side of the nose is normal when the trigger zone happens to be on lip or nose. Tapping or pressing such a tooth, sound or decayed, causes a shoot or paroxysm of

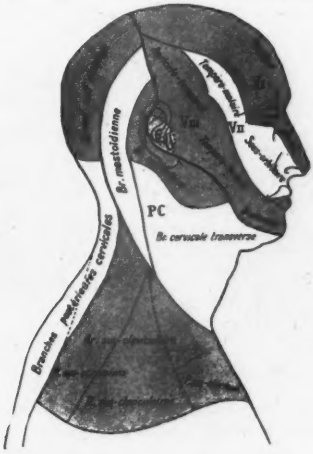


Fig. 4.—Tegumentary distribution of fifth nerve.

pain, and one may jump to the conclusion that the tooth causes the pain and should be removed. It would be as rational to cut out a piece of normal lip when stroking the lip starts the pain. Indeed, I have twice known this blunder (excision of a wedge of lip) to be made. How many sound and carious teeth have needlessly been extracted for trifacial neuralgia is beyond all estimate.

These trigger zones are peculiar to trifacial neuralgia; they occur in no other disease and are present in practi-

cally every case of this disease. But in no case is the trigger action constant. Especially, right after a paroxysm of pain, it may be impossible to start it by stimulation of the trigger zone. For instance, when the pain is started by eating, if the patient continues to eat until he has had a few sharp pains or paroxysms, oftentimes he can proceed with his meal in relative comfort. But a little patience and repeated examination will practically always show a trigger area to exist.

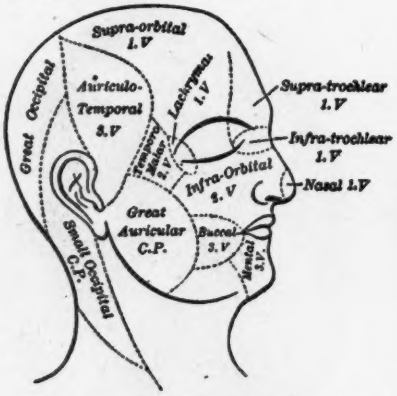


Fig. 5.—Tegumentary distribution of the fifth nerve.

Another strange thing about the trigger zone, which I believe I was the first to point out, is that it may be in a place where no pain is felt; may even be in the distribution area of a painless division of the fifth nerve. For example, the pain may be started by touching or rubbing the lower lip (supplied by the third branch), but the pain may be felt in the upper lip or wing of nose (middle branch), no pain at all being felt in the distribution area of the third branch. Rubbing the infra-orbital region may cause a supra-orbital shoot of pain, no pain being felt in the infra-orbital area and no pain being caused by rubbing the forehead. This fact has a most important bearing on treatment.

Very occasionally, the pain of tic douloureux radiates into the neck, the shoulder and even the arm; and, more rarely, using the arms or percussing them starts the pain.

I wish again to make a positive statement concerning the classic pressure points or tender points of Valleix. They are nonexistent, a myth, a legend that has been heedlessly believed for so long that it is accepted as a verity and finds

Fig. 6.—Zygoma cut away to show the sphenomaxillary fossa across which the second branch runs and where it is to be reached about 5 cm. from the surface.

a place in most textbooks. The infra-orbital nerve at its exit is no more tender to pressure in a patient with trifacial neuralgia than in any other person made sensitive and timid by much suffering. Of course, in the neuralgic patient, pressure over the infra-orbital foramen may start a paroxysm of pain. But that is not tenderness. It occurs because this area happens to be a "trigger zone"; and, by that same token, a brush by the finger scarcely felt by the patient may start an equally horrible paroxysm. "In short, the tender points of Valleix as such are absent in tic douloureux, pres-

ent in many other affections, and are a semeiologic delusion and a diagnostic snare."[2]

In this disease, there is no anesthesia, no analgesia, no hyperesthesia. Trifacial neuralgia is essentially chronic and tends to become worse as the months and years go by. As far as I know, it always starts in one branch and spreads to the others. It is sometimes confined to one branch for years. But if the disease is chronic and progressive, it always is

Fig. 7.—A skull in which a needle introduced back of the coronoid process can easily be passed into the sphenomaxillary fossa.

irregularly, uncertainly intermittent; lawlessly so. Not only are there rests between the individual jabs or paroxysms: there may be quite spontaneous, complete remissions for six months, a year, up to five years. Why this is no one knows.

### DIAGNOSIS

If one is familiar with the symptomatology, the diagnosis is already made. There is nothing else like this malady, except glossopharyngeal neuralgia, which is very rare. The sharp, instantaneous jabs are like nothing else. Paroxysms of excruciating pain starting suddenly and completely disappearing in a few seconds or very few minutes occur in nothing else, except tabes, and in that disease the pains are not in the face. No other pain like this is started by slight touches of the normal periphery.

Pain about the face that is steady, that is, a continuous throbbing, is not neuralgia. Any pain that is uniform for so much as half an hour is not neuralgia.

Fig. 8.—A skull in which the coronoid process of the lower jaw blocks off direct access to the sphenomaxillary fossa, this making injection of the middle branch of the nerve more difficult.

Any patient who washes the face, eats and drinks, brushes the teeth and combs the hair with impunity and without fear has not tic douloureux. Any painful condition about the face or head accompanied by sensory blunting is not neuralgia.

Any pain about the head or face in which there is real tenderness anywhere to pressure, or touch or percussion is not uncomplicated tic douloureux. Any painful affection which causes a rise of

temperature or leukocytosis or swelling is not trifacial neuralgia.

### TREATMENT

There is no nonsurgical treatment worthy of consideration. The choice simply lies between the radical operation (section of the sensory root of the fifth nerve between the gasserian ganglion and the pons) and injection of alcohol into the nerve trunk or into the ganglion

Fig. 9.—Drawing showing accessibility of the middle branch and lesser accessibility of the third branch.

of Gasser. All cutting operations on the nerve trunks are now to be condemned, whether done at the foramina of exit from the cranial cavity (Abbé) or at any point between this and the periphery. In proper hands, the operation of choice is the radical operation, but it is no operation for the average general surgeon. It is the only means of radical cure. In proper hands, it is practically devoid of danger and is uniformly successful. In my opinion, there are in the United States six or perhaps eight surgeons who are expert at this operation. There are perhaps a dozen more who do it well. Others should not undertake it except under exceptional circumstances.

Unless the patient is very old or very feeble or has a bad heart, tuberculosis, cancer or some other disease which will soon terminate life, it is the procedure to be urged. Otherwise, or if the patient definitely declines the radical operation, alcohol injections are to be recommended. They may be superficial, at the supra-orbital notch, into the infra-orbital canal or mental foramen, or deep,

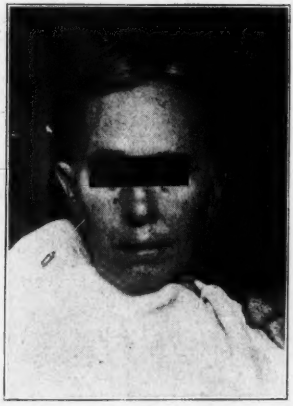

Fig. 10.—Needle in place for injecting the middle branch. The needle point is about 5 cm. from the surface.

where the middle branch leaves the foramen rotundum and the lower branch leaves the foramen ovale. Deep injection of the first division, I believe to be impracticable and unnecessary.[3]

Injections of the gasserian ganglion are made by two methods. In the method of Haertel, a long needle pierces the cheek about opposite the bicuspid and is directed upward and backward along the external surface of the external pterygoid plate, and so on through the foramen into the cranial cavity to

3. Patrick, H. T.: Technic and Results of Deep Injections of Alcohol for Trifacial Neuralgia, J.A.M.A., Jan. 20, 1912.

the point on the petrous portion of the temporal bone where the ganglion rests. In the other method (Harris and others), the needle is introduced in the

Fig. 11.—Needle in place for injecting the middle branch in another patient. (Compare Figure 10.) The mark external to the eye indicates the orbital process of the malar bone. The needle is inserted about 0.5 cm. posteriorly to this line.

Fig. 12.—Front view of case shown in Figure 11.

side of the face as far below the zygoma as may be so that it clears the inferior maxilla at the deepest part of the sigmoid notch, is directed upward, at a depth of about 4.5 cm., and passes through the foramen ovale and thus to the ganglion. Either of these methods is uncertain, I believe dangerous (espe-

Fig. 13.—Needle in position for injecting the third, lower or inferior maxillary division of the nerve at its emergence from (or entrance to) the foramen ovale.

Fig. 14.—Side view of case shown in Figure 13.

cially the former), and should be attempted only by an expert.

To inject the second division in the sphenomaxillary fossa, the needle is inserted below the zygoma (occasionally above), 0.5 cm. behind a perpendicular from the posterior edge of the orbital

process of the malar bone, is directed slightly upward and backward (occasionally slightly forward or straight in) and reaches the nerve at about 5 cm., where it emerges from the foramen rotundum. Figure 6 shows the zygoma cut away, fully exposing the sphenomaxillary fossa where the needle reaches the nerve. Figure 7 shows the zygoma and inferior maxilla in place and the sphenomaxillary fossa readily accessible. Figures 8 and 9 show quite different bony relations, such as frequently occur, making the injection much more difficult. Figures 10, 11 and 12 show the needle in position for injecting the superior maxillary division in the sphenomaxillary fossa just before it enters the foramen rotundum. (I now use a much more slender [irido-platinum] needle than that shown in the figures.)

Fig. 15.—Needle in position for injecting the third, lower or inferior maxillary division of the nerve at its emergence from (or entrance to) the foramen ovale.

To inject the third division at its emergence from the foramen ovale, the needle is inserted 2.5 cm. in front of the glenoid tubercle (Offerhaus), is directed slightly upward and backward and reaches the nerve at about 4 cm. This injection is more difficult or uncertain than that of the second division. The nerve is just posterior to the posterior border of the external pterygoid plate the pain will not be controlled. If a trigger zone is supplied by twigs given and it isn't a bad plan to strike this plate and gradually work the needle point backward until it slips by. It must then be quite near the nerve. Figures 13, 14, 15 and 16 show the needle in position for making this injection.

The superficial injections scarcely need description, but it is to be noted

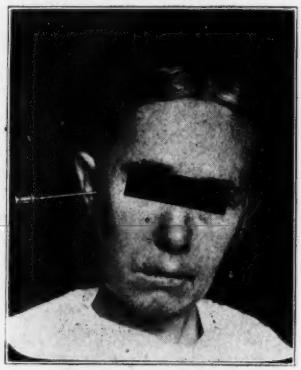

Fig. 16.—Front view of case shown in Figure 15.

that: 1. In injecting the supra-orbital nerve, the needle should follow along the nerve so as to inject it at several points for a little distance. 2. The same applies to the infra-orbital nerve; and to accomplish this, the needle must be inserted not over the foramen but below it and toward the midline, almost at the wing of the nose and just above the level of the nostril. 3. The mental foramen is about 4 cm. from the midline, and as the exit of this canal has various angles, one should try different directions so as to get the needle well into

the canal, and then force the alcohol as far as possible along the canal.

Now, in all injections, there is one imperative rule: The dolor-genetic, or trigger, zone must be made anesthetic or off far back (Fig. 2), the pain will not be stopped by a superficial injection. For example, if pain is started by stroking the soft palate or tapping an upper molar, injection at the infra-orbital foramen will do no good. If the pain is in the middle area, but a trigger zone is in the inferior maxillary area, the inferior maxillary must be injected to stop the pain.

# CONTINUOUS GUM APPLIED TO PARTIAL DENTURES AND REMOVABLE BRIDGES*

By JAMES L. HOWARD, D. D. S., Hollywood, Calif.

PORCELAIN is without doubt the most satisfactory of all materials as a substitute for the natural gum. It is strong, permanent in color, of proved quality, hygienic and, when properly applied, matches the gum perfectly. It has not been generally accepted by the dental profession because of the difficulty of manipulation and the uncertainty of results. This drawback can be overcome if the method of full denture construction recently published is followed. Also, the manipulation for partial dentures or removable bridges can be likewise simplified, if the technic given in this article is employed.

The most generally accepted technics of the past have required the use of long pin-teeth, soldered to a platinum base. This necessitated the subjection of the teeth to repeated high temperatures, as they had to go into the furnace each time a layer of porcelain was applied to the base; and, consequently, they became overfused and brittle. To offset this condition partially, lower fusing porcelain was used, and, as a result, strength of the base was sacrificed. If shrinkage or warpage of the base occurred during the firing process, and it always does, there was no chance of swaging it back to form because of the danger of breaking off the teeth; hence, the finished case did not fit.

By the use of pinless teeth and swaging between firings, all of the objections of the old technics are overcome, the procedure is shortened, and many new features are added. This not only applies to full dentures but to partial saddle cases as well.

The indications for continuous gum on partial dentures or removable bridges are many, but more particularly is it indicated in the case of a patient with a long gum ridge and a high lip line, who has been so unfortunate as to lose two or more of the upper anterior teeth, with a considerable amount of absorption of the alveolar process resulting. The ordinary partial denture restoration with the unnatural appearing pink rubber gum (Fig. 1), or the removable bridge or partial denture with long unshapely teeth

*Presented as a clinic before the Section on Partial Denture Prosthesis at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., August, 1928.

inclined lingually at the gingival margin, and abutting against the gum but half again as long as the adjoining teeth, are familiar sights to every dentist. (Fig. 2.) Cases of this kind are real tragedies in the lives of many people, and the restoration of these unfortunates to something simulating the normal should be more seriously considered. (Fig. 3.)

Following is the technic for applying continuous gum to partial dentures or removal bridges. It is in principle that previously given for full dentures.[1]

Fig. 1.—Ordinary partial dentures with unnatural pink gums.

Fig. 2.—Long unnatural appearing teeth abutting against gum.

The gold base for the partial denture or removable bridge is waxed up in the usual way, except that portion of the base upon which the teeth are to set, including the labial, which should be surrounded by a boxing or rim about 1 mm. deep. After the casting is made and finished, the bite is taken, the case is mounted on an articulator and pinless teeth are selected and set up. The case is now waxed up and tried in the mouth. (Fig. 4.)

The gold boxing affords insufficient retention for the porcelain block when completed; therefore, two or three 16-gage gold posts are located parallel to each other on the gold saddle, usually between the teeth or extending into the teeth, provided the teeth are parallel and there is sufficient room. These posts are waxed in place, invested and soldered to the base. (Fig. 5.) The teeth are returned to the gold base and waxed securely. A small amount of plaster is now poured upon a flat surface and the incisal edges of the teeth are pressed gently into this plaster to about 2 or 3 mm. in depth. (Fig. 6.) The gold base is also allowed to touch the plaster at three or four points, so that it may be removed and reseated accurately in

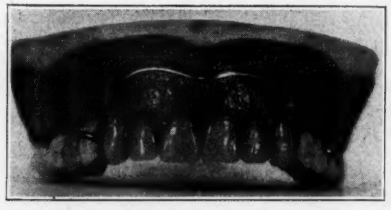

Fig. 3.—Continuous gum restoration of Figures 1 and 2.

Fig. 4.—Case waxed up for trying-in.

1. Howard, J. L.: Controlling Warpage in Continuous Gum Dentures, J.A.D.A., 14: 959 (June) 1927.

its place. The plaster is trimmed to one-half or three-quarters inch in width, following the arch form. A coating of thin shellac is then applied to prevent the plaster from crumbling and dusting off as the porcelain is being applied.

Pure platinum, from 36 to 40 gage, is burnished into the gold boxing and swaged securely to place. (Fig. 7.) As a precaution in swaging, a stone cast is run into the gold base and this is seated in the lower half of a vulcanizing flask. (Fig. 8.) Before being swaged, the

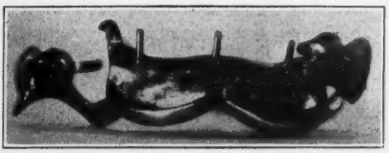

Fig. 5.—Pins for retention of porcelain saddle.

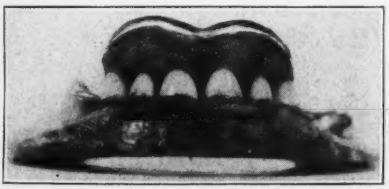

Fig. 6.—Teeth seated in plaster.

platinum is placed in the gold boxing of the base, and this in turn is seated upon the stone cast, which is then placed in the swager.

With the platinum swaged into the gold boxing, the next step is the application of the first layer of porcelain. A fine grade of porcelain, fusing at about 2,300 degrees, is used for the body or main bulk of the piece. As a guide to the amount and contour of the porcelain, the plaster rim containing the teeth is placed in position on the gold base. No attempt is made with the initial layer to fill in completely the space between the teeth and base, but it is desirable to have a thin, well-condensed layer covering the platinum and approaching, but not necessarily touching, the teeth. (Fig. 9.)

The platinum matrix containing the porcelain is now carefully removed from its gold boxing and placed in the furnace for the first firing, which should be to a high biscuit bake. When it is removed from the furnace and tried

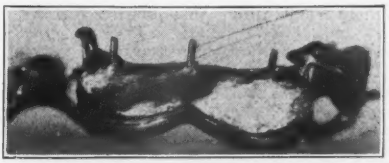

Fig. 7.—Platinum burnished, then swaged onto the gold saddle.

Fig. 8.—Platinum seated in vulcanizing flask for swaging.

back on the gold base, there probably will be indications of pulling away from the margins, and warpage. This is of little consequence because, after each firing, up to the time that the teeth are attached, the porcelain and platinum matrix is swaged to place in the boxing of the gold base, which is seated on the stone cast in the vulcanizing flask.

Either a second or a third layer of porcelain is applied, this depending on the distance between the teeth and the base

to be filled in. A sufficient amount of body porcelain should be used not only to reach the teeth, but to come down on the necks 0.5 mm., thus making definite depressions into which the teeth may again be seated after the porcelain has been fired. (Fig. 10.)

With this technic, it is not necessary to solder platinum tubes to the platinum base, with the idea of having these tubes slip over the gold pins projecting from the gold saddle. It is only necessary to ream out the hole through the porcelain slightly each time, just before placing

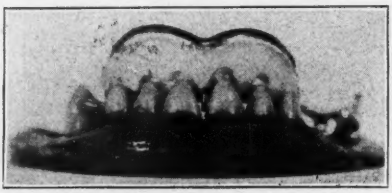

Fig. 9.—First layer of porcelain applied.

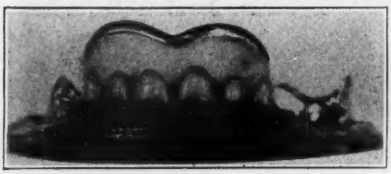

Fig. 10.—Porcelain built down to contact with the teeth.

the piece in the furnace, which will allow ample room for seating upon the gold pins.

If the technic has been carefully followed up to this point, the porcelain block should be seated definitely and accurately in the gold boxing, and the teeth, which are still set in the plaster matrix, should drop into their respective places in the porcelain, when the gold base is seated on the plaster matrix.

Sticky wax is next applied around the necks of the teeth, attaching them securely to the porcelain block or base; and the plaster matrix is removed from the incisal ends. (Fig. 11.) The porcelain block with teeth attached is removed from the gold base, and the teeth, after being given a coating of thick shellac, are seated in alundum cement (Fig. 12), which is dried thoroughly by being heated gradually up to redness. The teeth must remain in place during

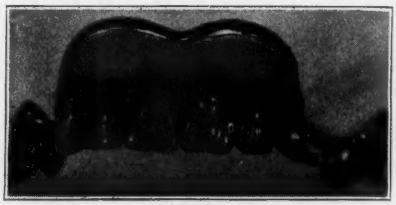

Fig. 11.—Teeth waxed securely to porcelain base.

Fig. 12.—Teeth seated in alundum cement.

this heating process, but the porcelain base can be removed as soon as the sticky wax melts. After they have cooled, the teeth, seated in the alundum cement matrix, are replaced on the porcelain block ready to be attached with porcelain.

At this point, to insure against the porcelain's getting into the holes which are to be occupied by the pins, little pieces of platinum foil, 2 or 3 mm. in

diameter, are pinched with the fingers over the ends of each pin, and the porcelain base, together with the teeth and alundum cement matrix, is pressed to place on the gold base. (Fig. 13.) On removal of the porcelain, the teeth and the alundum cement, the little pieces of foil will be found in the holes, where they will remain and function quite as effectively as if they had been soldered to the platinum base itself.

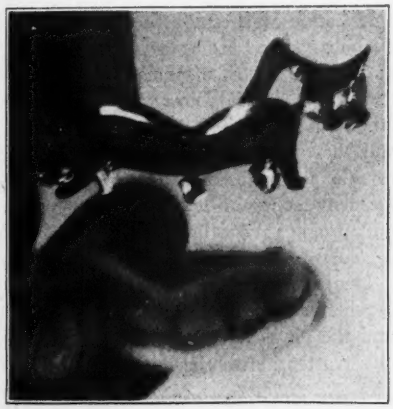

**Fig. 13.—Forcing platinum foil into holes in the porcelain block.**

The teeth are held in place by the alundum cement incisally and by the depressions in the porcelain block gingivally, while the porcelain is being applied around the gingival margins. Porcelain fusing at about 2,100 degrees is used to attach the teeth to the base. This insures against warpage because, at this temperature, the 2,300 degree body porcelain is not affected.

The platinum around the margin of the porcelain base is now removed and the final or pink enamel layer is applied (Fig. 14.) Removal of the platinum periphery permits the building of the pink porcelain down to a better contact with the gold boxing. The pink enamel fuses at about 2,000 degrees.

The remainder of the platinum base is stripped out and the porcelain block is cemented to place in the gold boxing, this completing the case.

The description of this work has required a great deal of detail, and an effort has been made to cover the subject thoroughly, but the practical application of the technic is much easier and shorter than the description makes it appear.

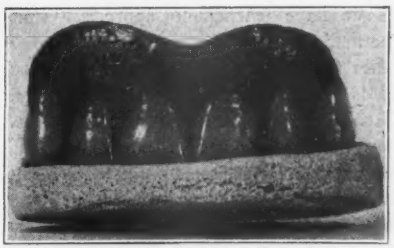

**Fig. 14.—Final or pink enamel layer applied to block.**

To do this work, little or no extra equipment is required, as most of the cases can be fused in an ordinary small porcelain furnace, and any good small swager can be used. This is a technic for the average general dentist, and it is hoped that many may be impressed with its importance as well as with its simplicity.

# MEANS OF MINIMIZING SHIFTING OF FULL DENTURE BASES*

By L. G. JORDAN, D.D.S., Woodside, N. Y.

ALL scientific achievements are the result of careful consideration of many factors in detail and *ensemble*. In no other manner can we as dentists hope to solve satisfactorily such an intricate problem as is presented by denture construction.

We have learned to appreciate that the fields of various sciences overlap each other and that findings in other scientific fields can often be utilized to advantage in the solution of our denture problems. New discoveries and interpretations of proved value promote progress. They force us to accept new methods, often superseding cherished traditions.

As individual dentists, we are each charged with a share of the responsibility of contributing to progress in dental art and science. Therefore, we must be ever on guard not to fall victim to vogues and ill-founded theories, which clog the avenues to progressive thought and improvement. We can enhance our personal efficiency by exchanging and sharing views with our confrères and thus render a service to the public which conforms to the very best that scientific dentistry has to offer. This paper is an effort in that direction. It will deal with a few factors of importance in the consideration of denture stability.

The first important step in denture prosthesis is the diagnosis. We have suitable and well-established procedures which commend roentgenographic examination, the study of models and other means which we know are all worth while investments for both the patient and the operator. A complete diagnosis reveals valuable data bearing on the problems confronting us and suggests a fair prognosis of the results to be expected from our efforts and skill.

Denture stability involves two main considerations, namely the physiologic and the physical, of which we will give closer attention to the latter.

## PHYSIOLOGIC CONSIDERATIONS

Many of our patients are in a state of health which is far from conducive to making them what we might term good denture patients. It often is good policy to delay denture service until the health of such patients has improved. Patients who exhibit a faulty calcium metabolism probably present the most difficult problem from a physiologic standpoint. In this group, we find the highly nervous and sensitive patient. Blood analysis for these patients usually reveals a disturbance of calcium balance, which in the absence of disease elsewhere in the body may be improved by the aid of ultraviolet radiation in the form of di-

*Read before the Section on Full Denture Prosthesis at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 22, 1928.

rect sunlight, properly filtered artificial radiation, and cod-liver oil; such treatment to be supplemented by a properly regulated diet and general hygiene. Until partial physiologic balance has been brought about, these patients will present quite unfavorable denture supporting structures.

A well prepared ridge[1] hastens the time when the denture bases will rest comfortably and securely upon the underlying tissues. This, in turn, will assist in creating comfort and in generating an optimistic frame of mind in the patient who is passing through that long-dreaded ordeal of wearing the first dentures.

## DENTURE ADAPTATION

Having touched lightly on the physiologic aspects affecting denture stability, I shall now proceed to a consideration of the physical problems, remembering at all times that the physiologic status of the patient is also important to denture stability.

In the mouths of patients who have been wearing unbalanced and ill-fitting dentures, we are sure to find areas of loose, flabby mucosa and underlying tissue, forming an unstable, unsatisfactory and frequently very sensitive foundation for the denture bases, upon which are placed delicately articulated teeth. In many cases, annoying, flabby tissues are removed by a very simple surgical operation. The denture-bearing areas left are sometimes flat, but nevertheless present a more favorable foundation upon which to support the denture of our choice.

In order to obtain the desired adaptation and stability, I have found it most satisfactory to use impression methods which develop denture seating areas distributing masticatory loads over the most acceptable area, while relieving the others. That, of course, is a matter of making suitable impressions.

It is frequently observed that the borders of the maxillary denture bases are insufficiently extended, especially in the posterior regions, between the tuberosities, and that the borders of the average mandibular base are overextended, especially along the lingual.

A lack of extension of the flanges and borders of both the maxillary and mandibular denture bases was often caused by unnecessary trimming, intended to eliminate trauma. Such trimming usually diminished retention and also denture stability without satisfactorily accomplishing the intended purpose.

The mylohyoid ridge constitutes the lateral insertion of the mylohyoid muscle, which makes up a large part of the floor of the mouth. It is along the mylohyoid ridge that the mylohyoid muscle and its adjacent tissues are deflected toward the tongue. Here, they exert a dislodging influence on the overextended mandibular denture base during excursions of the tongue into the buccal cavity, to the right or left anteriorly, and during the act of swallowing. Extension of a denture base below this ridge seriously interferes with stability.

The maxillary as well as the mandibular impression should by all means be reduced to the limits we desire the finished base to occupy, because an overextension of the impression distorts the tissues, resulting in loss of adaptation of the finished denture base.

So much about the requirements of form and extension of the denture bases. We will now proceed to a consideration of the masticatory surfaces.

1. Sears, V. H.: Indications for and Limitations of Alveolectomy, Dent. Cosmos, 68: 1187-1190 (Dec.) 1926.

### ALLOCATION OF DENTURES IN THE MOUTH

We assume that the teeth should be arranged in balanced occlusions[2] and set up to best accommodate the existing ridge relation and surrounding tissues. To begin with, we accept the anatomy of the individual case as a guiding factor for dimensioning and allocating dentures. In the available space, the dentures must fulfil the esthetic requirements, which means that they and the re-

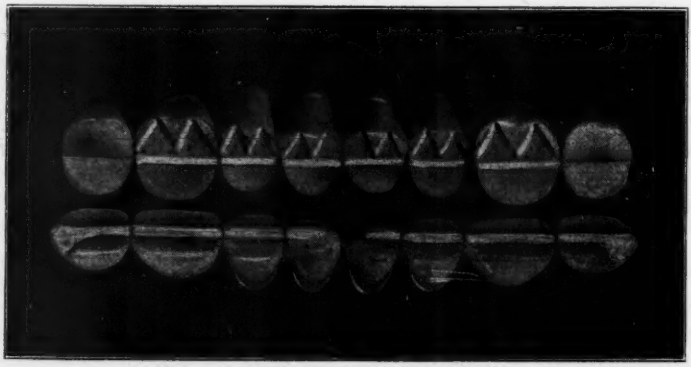

Fig. 1.—Occluding surfaces of upper and lower channel posterior teeth.

arranged facial tissues shall be pleasing to the eye when the case is finished. Teeth must also function in order to masticate and, when not masticating, must not interfere with speech nor inconvenience the patient otherwise.

The relation of the teeth to the denture bases is an important matter, for it may affect denture stability. The closer we can place the masticatory surfaces to and over the supporting areas, the greater will be the stability of the denture. This is clearly evident from an example which I shall interject.

2. Sears, V. H.: Balanced Occlusions, J.A.D.A., 12: 1448-1451 (Dec.) 1925.

We know that the stability of a table is dependent upon (*a*) the polygon circumscribing its points of support and (*b*) its height in relation to any disturbing force. Assuming that the base area of the table remains the same, we may enhance or increase the stability of the table by decreasing the table height. We may further increase its stability by decreasing the table top area where we expect disturbing forces to attack. Mechanically speaking, we lower the point of attack of forces and place the point in a more favorable position over the area of support.

Likewise, we may enhance the stability of dentures by keeping the masticatory surfaces in close proximity to maximum supporting areas.

Owing to the bulk of the teeth, the existing ridge relation and esthetic and functional considerations, it will not always be feasible to accept a closure of the jaws which produces the most favorable statical condition conceivable.

### MASTICATORY SURFACE FORM AND FORMATION

The masticatory surface form of the teeth presents an additional problem.

These surfaces are not arranged in a continuous flat surface above the ridges. The cusps deflect the forces of mastication in directions perpendicular to their inclines. I may sum up by saying that high cusps with steep inclines deflect the forces of function in directions unfavorable to denture stability, while low cusps with flatter inclines will direct these forces less unfavorably to the supporting areas.

This effect was recognized very early by the profession, and only in consequence of using various types of teeth as developed by tooth manufacturers. The early forms of artificial teeth were crude copies of anatomic forms. They were made with little regard for efficient masticatory function, and seemingly only with accidental regard for denture stability.

Then came a period when great stress was laid on reproducing anatomic tooth form. It is regrettable that whims quite frequently were responsible for the general application of exaggerated tooth forms and tooth alinements. You are here reminded of the beautifully carved teeth by House. These teeth exhibited exaggerated cusps and in use showed their inherent disadvantages very soon. Fortunately, the trend to select extremes is being abated and replaced by the saner use of lesser cusp height, moderate incisal guidance and recognition of the compensating curves.

## PROSTHETIC FUNCTION

For some years, we were told, and sincerely believed, that artificial teeth should be possessed of every natural anatomic detail in order to afford a prosthetic denture function which was proposed to be identical with natural denture function. Many of our confrères today still hold to such misleading traditions. During the last few years, it has been realized by some that prosthetic function is not identical with, but equivalent to, natural anatomic function. In consequence of such revelation, it is not difficult to accept the reasoning that prosthetic denture occlusal surfaces need not be exact replicas of anatomic units. This reasoning is responsible for the fact that modern tooth forms, where invisible, lack anatomic detail to increase the mechanical function of the prosthesis in the mouth.

Tooth forms of near anatomic form yet of pleasing appearance and exceptional masticatory efficiency are now more generally demanded. Advanced manufacturers are supplying the market with artificial teeth resembling the anatomic forms very closely, yet not overloaded with anatomic minutiae. Recently, we have tried, accepted and approved tooth substitutes where they are exposed to view, and give preference to mechanical requirements, in form and arrangement, where these teeth are hidden in the mouth.

## SPECIAL TOOTH FORMS

There are several tooth forms now available which follow the foregoing line of reasoning: two German tooth-forms, of which the pestle and mortar type by Schroeder is very promising in many respects, and two American forms. Gysi also further developed an idea of using what he terms cross-bite teeth. Almost simultaneously with the marketing of the cross-bite type of teeth, there appeared the channel type tooth, developed by Sears.

The masticatory surfaces of the molars and bicuspids of all these modern tooth forms are but a compromise in favor of mechanical function. I am

not in a position to furnish you with authoritative information regarding the individual characteristics and merits of all the various new tooth forms. I shall merely present illustrations obtained at the source and in the literature. In my practice, I have used channel type teeth, and thus have had an opportunity to get acquainted with their application and function. I shall therefore give special consideration to this new tooth form, giving views on them as a practitioner only.

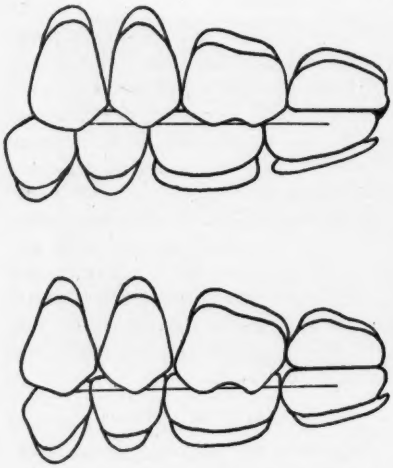

Fig. 2.—Buccal view of channel posterior teeth. These teeth may be set up in varying anterior-posterior relations without interferance with centric relation intimacy.

One of the basic reasons for applying channel type teeth is, as I see it, the fact that the cusp inclines mesiodistally are reduced to a minimum by continuous cusp ridges articulating in continuous channel sulci, both extending from the cuspids to the last molars inclusively. (Fig. 1.) The absence of cusps in a mesiodistal direction minimizes the centric relation problem in the anteroposterior direction. (Fig. 2.) The horizontal surface at the base of the channel permits a slight lateral play of the mandibular cusp ridge.

I do not infer that inaccuracy in securing centric relation records is to be tolerated, but I am now convinced that a slight freedom of movement in centric relation will result in a greater number of dentures being acceptable from the standpoint of balanced occlusion in centric relation, the key position in which masticatory excursions terminate.

The absence of cusp inclines mesiodistally considerably decreases the inclination of the incisal guidance. That may not always be desirable, but it is of importance to note that the peculiar design and the consequent tooth alinement of channel type teeth favor denture stability anteroposteriorly.

There are three main features which recommend the channel type tooth from the point of view of denture stability: (1) the lessened masticating area as compared with the anatomic forms; (2) the absence of lingual cusps on mandibular posterior teeth, and (3) the inclined surface of the mandibular tooth ridges. I will consider these features in the order named.

Reducing the cutting surface of an instrument reduces the amount of power required to force it through a given substance. The application of this principle to tooth form surely is a partial solution of the problem of traumatized tissues. Theoretically, this would necessitate a greater number of strokes for the mastication of a given bolus of food, which is not a decided detriment, but a noteworthy advantage, because the patient will perform mastication with more ease and thoroughness.

The absence of lingual cusps decreases the distance which the tongue has to

travel from its position of rest to the buccal cavities and thereby lessens the displacing influence of the tongue on the denture. This factor also permits a greater jaw separation where indicated, without noticeably decreasing the inherent stability of the denture base.

The direction of its inclines laterally results in two distinct advantages, namely, the retaining influence exerted by the tongue and the distribution of forces within the area of support. The ability of the tongue to exert a retaining influence is enhanced by the prismlike forms of the mandibular tooth ridge. The lingual surfaces of the mandibular posterior channel teeth are always diverging and form a fairly continuous surface with the lingual surfaces of the body of the dentures. The pressure of the tongue against those diverging surfaces causes a downward force which aids in keeping the denture seated.[3]

The distribution of forces within the area of support is shown in Figure 3.

The inclines of the channel type teeth in a lateral direction do not offer a new problem; for we may set up these teeth in the manner that we handled the cusp type teeth. The fact that a continuous grinding surface extending mesiodistally exists does not interfere with known requirements of individual, harmonized, grinding surfaces along the dental arch.

In these cases in which channel teeth are indicated, and we feel that they have a very wide application, it will be found that the setting up of these teeth is far more facile than that of anatomic teeth, so-called.

## BALANCED ARTICULATION

Thus far, we have spoken of conditions and forms which are conducive to stability. We now point out that favorable conditions found or produced in the supporting areas and the judicious use of material and parts for the denture are not all. It is also necessary to follow strict physical laws when associating physical and anatomic parts, if these are to function satisfactorily.

Satisfactory physical denture function is balanced articulation, which is but a change from one balanced occlusion into another while the masticatory surfaces remain in contact.

Balanced articulation is accomplished by selecting and associating appropriate cusp height and tooth form in the most favorable and acceptable position.

The proper selection of cusp and tooth form was at one time, as we indicated above, a very arbitrary procedure from the point of view of masticatory efficiency, and so was the arrangement of teeth. Today, we are more fortunate, as we now possess definite laws.[4] These laws, known as the laws of articulation, were first given in comprehensive form before this Association by Hanau, at Louisville, in 1925.

Physical and physiologic function are are reciprocally related. The disturbance of one is sure to aggravate the other, no matter how inconspicuous the disturbance appears to be in the beginning.

## CONCLUSIONS

Essential to stability in dentures are:

1. The preparation and the utilization of the largest permissible supporting area afforded by the tissues.

2. An appropriate reproduction of these areas in compliance with future requirements.

3. Sears, V. H.: Channel Type Posterior Tooth Forms, J.A.D.A., 15: 1114 (June) 1928.

4. Hanan, R. L.: Articulation Defined, Analyzed and Formulated, J.A.D.A., 13:1694 (Dec.) 1926.

3. The design and construction of well adapted denture bases and superstructures.

4. The selection or the production of masticatory surfaces, tooth forms and tooth arrangements most appropriate for the anatomic and esthetic requirements of the patient.

5. The most favorable allocation of the masticatory surfaces.

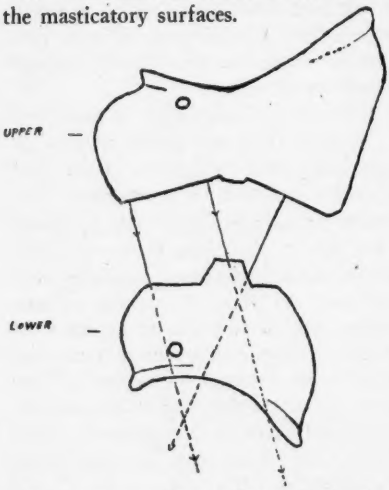


Fig. 3.—Cross-section of channel posterior teeth, showing the distribution of the occluding forces within the area of support of the mandibular posterior teeth.

6. Masticatory surface formation in conformity with the dictates of the laws of articulation.

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DISCUSSION

*C. E. Rudolph, Minneapolis, Minn.:* The title of this paper implies such a tremendous amount of prosthetic procedure that it must be obvious to all that it is impossible to present even essential details in the time allotted. The effort to give you a volume through suggestion is, possibly to be commended from the point of view of the dentist of considerable experience, who can follow the sequence of thought and fill in the details, but might be open to criticism by the younger practitioner who is unable to do this. In order of presentation, Dr. Jordan mentions two main considerations relating to stability; namely, the physical and the physiologic. It has been demonstrated many times that both these essentials may be all that may be desired in the patient and still the denture service be a failure. Add to these the physiologic factor, and remember the many fine points in diagnosis tabulated by M. M. House, if success in the greatest number of cases is to be expected. I can not refrain from emphasizing the necessary procedure in cases of flabby tissue. It might be well to make mention of the possibility of mistakes in surgical procedure, especially in cases in which tuberosities of the maxilla are involved. In my experience, not always is it wise to be too radical where tuberosities are involved for fear we sacrifice stability rather than aid it. Too little stress has been laid, in this presentation, on impression taking. After the proper diagnosis, no other procedure makes for success or failure as does this phase. It will be of very considerable interest to this group to observe Dr. Jordan's methods in the promised clinic. The reference to the allocation of masticatory surfaces to receive the muscle strain should be kept in mind clearly, for it is one of the important points in the stability of the denture; and we should remember at all times that muscle forces in the average case, even, are more complicated than we wish to recognize. The proper allocation of the masticatory surfaces is of more importance than the debate over the particular type of tooth a man should adhere to in the average case. However, it takes all sorts of opinions to stimulate men to make progress, and the controversy over tooth type is sure to establish some more rational basis in the future if it is found that our present forms are inadequate. Selection of teeth to harmonize in all respects with the patient to be fitted as far as the operator can determine seems sensible, and the placing of the average individual in a class which takes a given type of tooth appears a bit radical. Although I have had no experience with channel teeth, I should like to raise the question regarding the large flat surfaces in the posterior teeth designed for mastication. Making chewing surfaces of this type

has been discouraged by most teachers, to date, for the obvious reason that it takes too much force to crush the food and there are no cutting edges to triturate it. Instead of less pressure being exerted on the mucosa over the ridge, more pressure must be exerted to do the same work. Of course, there is nothing to interfere with the mesiodistal position in central occlusion, and this, in a small percentage of cases, may be an advantage. It seems clear that too much time has been spent and too much stress been laid upon the type of tooth that Dr. Jordan offers as a panacea for stabilizing dentures, and too little offered on the fundamental prosthetic procedures necessary to insure successful denture stability. The stress laid upon balanced occlusion must be remembered and practiced, whatever type of tooth is used. Far too many practitioners depend on the dental laboratories to return a finished, successful set of dentures with nothing to work from but a mush bite in modeling compound. There is stimulus for all in the many points mentioned by Dr. Jordan, and any word or suggestion which will cause the average practitioner to think more deeply on this subject is very much worth while.

*Alexander S. Diack, Detroit, Mich.:* The outstanding part of Dr. Jordan's essay is found in the first two paragraphs: "We have learned to appreciate that the fields of various sciences overlap each other and that findings in other scientific fields can be utilized to advantage in the solution of our denture problems." The science of chemistry, the greatest of sciences, is by far the biggest factor in our modern civilization, and on chemistry the future of our profession will greatly depend. The most astounding marvels of our day, in industry and the arts, have been the result of applied findings of the chemist. Now, with the exception of our medicaments and a few metallic alloys, chemistry, until recent months, had done very little for prosthetic dentistry. To chemistry, we must turn our attention, if we expect to solve the problems which have, in the past generations, prevented comfort and pleasure in wearing artificial dentures. Let us be frank about "store" teeth. How do they differ today from the very first attempts to build plates? Practically not at all, in respect to our problem. The beautiful finished denture of today is a more or less rigid, nonyielding unit, made up of very hard substances; so hard, in fact, that it would no doubt give forth a musical note if properly vibrated and our auditory nerves were capable of receiving it. Of course, the hard unyielding base is essential as is also the very hard occlusal surface, but why have we not before this interposed a medium to break or interrupt that continuity of hardness so shocking in its impact and thus distribute a movement that we acknowledge is the inevitable result of superimposing a hard surface on a vascular membrane? It is hardly to be expected that much progress will be made in minimizing the movement of dentures until they are so made that the continuity of hard materials, necessarily entering into their construction, is interrupted or broken by the interposition of some yielding medium, either in the form of an artificial pericemental membrane or a laminated process or by some means of introducing a factor of time, be it ever so short, in the contact of cusp on cusp. With the rigid hard denture of today, the shock of impact of one point or cusp is instantaneously transmitted to the entire plate. To illustrate, let us imagine ourselves sweeping a concrete surface first with a shovel and then with a broom and noting the difference in the contact and the effect on our arms. Not only would such a construction minimize the movement, by distribution, but it would also solve the problem of noisy clacking dentures. I have ground block teeth for retention in the base and used a rubber dam for an artificial pericemental membrane with satisfying results, but while the dam attaches to the base, it does not produce a close union with the porcelain and, of course, permits fluids to enter. For obvious reasons, the teeth secured with pins are not suitable for this purpose. Our great hope lies in chemical development of materials that will revolutionize the dental prosthetic art and enable us to simulate more nearly the normal dental equipment. This thought is offered in the hope that some fertile brain will accept the challenge and perfect materials and technic which will afford a little more comfort for millions.

*Dr. Jordan (closing):* Dr. Rudolph mentions the fact that I possibly left out a few detailed technical descriptions which might have been clarifying to the listener. I would agree with Dr. Rudolph had technical considerations been the purpose of this paper. It has always seemed to me that the purpose of this particular gathering was the discussion of principles and theories rather than technical details. If I understand Dr. Rudolph correctly, he inferred that the cusp ridges of the mandibular posterior teeth were easily ground off in balancing the case, leaving a broad occlusal surface in contact with the broad occlusal surface of the maxillary posterior teeth. It is true that grinding is sometimes necessary in the correct articulation of channel teeth, but, in most cases, it may be limited to the maxillary posteriors. In any event, occlusal contact in centric relation should be limited to the narrow mandibular cusp ridge against the channel sulcus of the maxillary teeth. The buccal and lingual slopes of the mandibular posteriors should be ground when necessary to bring about this condition. Dr. Diack suggests the use of some resilient intermediary between the teeth and their supporting base as a possible solution to the problem of traumatization of tissue under denture bases. It is only within recent years that we have had available procedures which take into consideration the resiliency and like effect of tissues involved in denture work and the excellent results obtained through these procedures would hardly warrant the incorporation of another questionable factor. Balanced articulation seems to solve the problem of traumatized tissue.

# EARLY LOSS OF TEETH—A STUDY OF EFFECTS*

By BURNE O. SIPPY, B.S., D.D.S., M.S., Chicago, Ill.

A CAREFUL study of the growth of the face and jaws shows the close relationship between the development of the denture and the functions of respiration, mastication, deglutition, expression, etc. It is evident that Nature's plan, if not interrupted, is to produce well-developed bones and balanced muscles of the face and jaws. The maxillary sinuses, the nasal passages and the mandible will be fully formed, the nasal septum will be straight and regular and there will be normal functions and occlusion. When this condition of development is seen in individuals, general good health, normal development of the body and freedom from maladies are also in evidence.

During the progress of development of the child, there are many disturbing influences which, if of sufficient duration or character, have a general influence in checking the normal development, and which may have a specific influence in checking the normal development or modifying the development of the face and jaws, particularly the denture.

The mandible performs two important functions, namely mastication and respiration. It should be recalled that, at birth, all of the teeth, except the second and third permanent molars, have begun to develop. In the upper jaw, they occupy almost all the space to the floor of the nose and orbit, there being

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little indication of a maxillary sinus. Each tooth germ is enclosed in a crypt, a wall of cribriform plate having spicules of cancellous bone. As the tooth develops, pressure is created, and the crypt wall is pushed backward through cancellous bone. The growing tongue and the organs of the mouth exert pressure from the lingual side. The muscular forces from outside, namely, the muscles of mastication, deglutition, respiration and expression, act as mechanical stimuli to produce a reaction of connective tissue cells, resulting in growth. Growth of the root causes absorption of the roof of the crypt as the tooth moves occlusally, cutting through the overlying soft tissue. As the tooth moves occlusally, the bone grows with it, and thus the alveolus is formed.[1] The thickness, the length and the width of the jaws increase as the teeth grow outward, forward and occlusally. The maintenance of the normal relation of the jaws to each other and the development of the maxillary sinuses, the nasal passage and the septum depend on the balance of these forces. A lack of these normal forces or a change in the direction of these forces may entirely change the development of the bones of the face and jaws. The early loss of teeth usually produces such a disturbance and results in malocclution. The seriousness of this malocclusion will depend on the character and extent of the disturbance and the time of its occurrence.

When a patient shows the effects of the foregoing conditions, a complete case history should be obtained and full mouth roentgenograms and photographs, and orthodontic casts should be made before a complete case analysis can be offered. Frequently, it is necessary to have extra-oral roentgenograms and a face mask cast in addition. The general features should be carefully studied in order to get as broad a view of the conditions as possible; then, the specific details may be worked out more accurately. The classification of the malocclusion should be determined, and this should be the principal basis of the plan of treatment and the retention plan.

What are the contributing factors to the early loss of teeth? Much has been said on the subjects of prenatal conditions, faulty diet resulting in tooth and bone structure, children's diseases, particularly eruptive fevers, caries, etc. All of these are contributing factors; but it is not within the scope of this paper to review such discussions or to comment on them. The premature loss of deciduous teeth, accidents to permanent teeth, congenital absence of teeth, extraction of teeth, postoperative conditions in connection with cleft palate and harelip and the surgical removal of tumors involving the face and jaws are also important and immediate contributing factors.[2]

In the premature loss of deciduous teeth, we find a regular and almost certain cause of malocclusion. This premature loss may be the result of neglect of caries, and the progress of destruction may warrant an early extraction. Should this occur in the area where there is no developing permanent tooth soon to take its place, the mutilation is greatly increased. Not only do we find the usual malocclusion resulting from the premature loss of deciduous teeth, but the lack of any development in the bone because of the absence of the cor-

1. Noyes, F. B., and Thomas, N. G.: Textbook of Dental Histology and Embryology, Philadelphia: Lea & Febiger, 1921.

2. Sippy B. O.: Consideration of Malocclusion in Mutilated Cases, J.A.D.A., 15: 2057 (Nov.) 1928.

responding or adjacent permanent tooth. Even after all of the teeth are erupted, accidents occur that may remove the teeth completely or make their removal necessary. Likewise, removal is usually necessary when a tooth is in the line of fracture of the maxilla or mandible.

There are two forms of extraction, the necessary, or unavoidable, and the pernicious. When a child comes to the dentist for the first time with a tooth so badly involved by caries that it is not scientifically or humanly possible to save the tooth, it must, of course, be extracted. It is pernicious to extract deciduous teeth prematurely merely because there is a cavity to be filled, with the excuse that the child is not a good patient, or that time is too precious, etc., to make the necessary effort to save the tooth. The other form of pernicious extraction is that of a perfectly normal and healthy tooth, to correct the crowded condition of certain teeth, which, again, may relieve the situation for the time being, but inevitably produces serious consequences at a later date, perhaps years afterward.

A few weeks ago, a boy, aged 9, who had been under management for one year by an orthodontist in New York, came to my office. The first step in the management of his case had been the extraction of the eight temporary molars and four temporary cuspid teeth, twelve in all, at 8 years of age. This left eight permanent anterior teeth and four first permanent molars, twelve teeth in all with which to manage his food. The mother accompanied the boy and assured me that the twelve temporary teeth extracted were in good condition, having no fillings and no cavities, and were extracted intentionally as a plan of management of the malocclusion. When it is considered that this boy has been without half the teeth that he normally should have for over a year, it is not surprising that he has been suffering from gastro-intestinal disturbances of such a serious nature that it was necessary to place him in the hands of an internist. From an inspection of the roentgenograms of his mouth, it is evident that his bicuspids and cuspids will not erupt for at least two years, as they are deep in the bone and making little progress in root development. Therefore, the boy will be deprived of half of his teeth for at least from three to four years. With our understanding of the development of the denture and the growth of the bones of the face and jaws, and the functions of the teeth, may this not be justly called malicious extraction of deciduous teeth? This is but one actual example that might be cited of premature extraction of teeth for the correction of malocclusion.

What will be the results when a deciduous cuspid is lost early in the life of the deciduous denture, if the latter is not properly safeguarded? The results are practically assured: The permanent central and lateral incisors will occupy the space of the deciduous central and lateral incisors and also that of the lost deciduous tooth, with no place left for the corresponding permanent cuspid tooth. The arch will be short and narrow, with crowded and malposed teeth, and like influence will be exerted on the opposite jaw.

What will be the results of the early loss of a temporary molar tooth, if there is no safeguard? The permanent first molar, on its eruption, in that quadrant of the denture moves mesially. The lack of pressure mesially owing to the space thus created, allows the anterior teeth in that arch and the first bicuspid to erupt, to take their place distally to

their normal positions, and, consequently, there is no place for the last bicuspid. It may remain imbedded in the bone and become an impacted tooth, or it may erupt outside the arch to the buccal side, but usually makes its way to the lingual. The shortening and narrowing of that arch of course has its influence on the opposing arch, and a corresponding form of crowding and malposition of teeth occurs in the opposite jaw.

What will be the results of the early loss of a biscuspid tooth, shortly after all of the permanent teeth have erupted? If the occlusion is not perfect in its inclined plane relation, spaces will begin to develop between the teeth, a shifting, drifting and rotation of the teeth occurs, many times to a surprising degree in a very short period of time, and the serious disturbance of an otherwise very good occlusion results.

Accompanying these conditions just mentioned, there is usually a shifting of the median line either to the right or to the left, this depending on which quadrant of the arch has lost the tooth. There will be a failure of development of the bone in that part of the arch, and probably a lingual occlusion will result, and, in some instances, a cross-bite in the region of the anterior teeth. A corresponding lack of development of the maxillary sinus, deflection of the nasal septum and warping of the lower part of the face are frequently accompanying symptoms.

One might continue citing such examples involving every tooth in the deciduous and the permanent denture, showing full mouth roentgenograms, photographs and orthodontic casts illustrating a large variety of such effects, as such cases are seen every day in the practice of orthodontia. In all instances of the absence or loss of teeth for any cause, it is not so much the absence of teeth as the failure to provide adequate artificial substitutes that causes the damage to the developing denture.[3] Space retention should be employed early in all instances. In the deciduous arch, very simple retention is all that may be necessary for a short period, and it should be modified at intervals or remade to suit the conditions of growth. It should be continued until the corresponding permanent tooth erupts to a stage where it will have an opportunity to maintain the normal influences by its further and complete eruption. If it is a permanent tooth that is lost or is absent, space retention should be maintained until the patient reaches an age when a permanent bridge restoration may be safely and successfully placed. This form of prevention of malocclusion is frequently overlooked, and unless it is carried out, there is usually considerable shifting of the teeth or a failure of complete development of the dental arches.

I have made a study of the effects of the early loss of teeth in growing dentures and in adult dentures, and I have no hesitation in saying that of all the etiologic factors involved in malocclusion, none are so important in point of frequency of occurrence, or more far-reaching in their influence in disturbing occlusion and the normal form and functions of the face and jaws than the early loss of teeth. In the study of this problem, data were taken from orthodontic models made from impressions of the mouths of a group of about 400 individuals, from childhood to 30 years of age. This collection of models was begun by me in my orthodontia clinic of the University of Illinois College of Dentistry

3. Sippy, B. O.: Importance of Space Retention in Maintaining Occlusion, J.A.D.A., 15: 1727 (Sept.) 1928.

in 1918. The mouths represented by this group had received the ordinary dental care, but no orthodontic management. From this group of models, 100 were selected which showed the loss of teeth and were grouped for intensive study. Each model was then analyzed from the point of view of the relationship of the loss of teeth to the condition of the occlusion or the malocclusion.

Time is not allowed for a complete presentation of the findings in this study of each model or even of the groups of models. A summary of the findings is given in the accompanying table:

SUMMARY OF FINDINGS IN STUDY OF 100 MODELS

| Number of Models | Findings |
|---|---|
| 64 | First permanent molars missings |
| 36 | Other teeth missing |
| 68 | Malposition of teeth associated with missing teeth |
| 32 | Apparently not affecting malposition of teeth |
| 62 | Arches short or narrow, or both |
| 38 | Length and width of arches apparently not affected |
| 85 | Spaces with no artificial restoration |
| 15 | Spaces maintained, or partly so, by bridgework |
| 21 | Spaces developed between other teeth |
| 79 | Contacts preserved in other teeth |

It will be noted that 64 per cent of the models show from one to four first permanent molars missing. Thirty-six per cent have first permanent molars and other teeth missing, not to include third molars, which are beyond our consideration, as a recording of the roentgenographic findings would be necessary in each case. In 32 per cent of the models, there is apparently no malposition of other teeth involved, but in 68 per cent of the models, there is a definite malposition of other teeth associated with the loss of teeth. The length and width of the arches are apparently not affected in 38 per cent of the models, but 62 per cent have either short or narrow or both short and narrow arches. Eighty-five per cent show spaces where teeth are missing, while 15 per cent have spaces maintained or partly maintained by bridgework. In 79 per cent, the contacts of other teeth were preserved, although 21 per cent have open contacts as the result of tipping, rotating or shifting of other teeth in the denture apart from the missing teeth.

As regards the effects of the loss of the first permanent molar, the result of an intense study of this problem has been presented elsewhere.[4] It may be said, as a finding of this earlier study, that the first permanent molar is the one of all the teeth which has been the prey of the extraction forceps, and particularly the lower first permanent molar. That its loss is not an advantage to any denture, as it causes a shortening or narrowing or both of the arches, and a tipping, rotating or drifting of adjacent and other teeth, thereby decreasing masticating efficiency, and its extraction does not correct but rather increases an existing malocclusion, was substantiated by that study.

The 36 per cent having other teeth missing presents an interesting comparison. Stated in the order of their frequency, the missing teeth are as follows: third molars, 44; second bicuspids, 26; second molars, 13; first bicuspids, 11; lateral incisors, 7; cuspids, 2; and central incisors, 1. May I recall to you again that the first molar heads the list, with sixty-four missing, the third molars are next in order, with 44 missing, the bicuspid teeth following with 37 miss-

4. Sippy, B. O.: Effects of the Loss of the First Permanent Molar, J.A.D.A., 14: 1953 (Nov.) 1927.

ing. The second permanent molars are next, with 13 missing, and the six anterior teeth come last, there being 10 missing. The effects on occlusion of the loss of teeth just tabulated may be expressed as follows: 33 teeth are rotated to a considerable degree, many turned as much as 45 degrees on their long axis; 23 teeth are in supraclusion or are protruding; 30 teeth are either in lingual, buccal or labial occlusion, the larger percentage being in lingual occlusion. In thirteen models, the anterior teeth are very crowded. In twenty-one models, the teeth have separated, with considerable spacing between individual or groups of teeth apart from the place of the missing teeth. Is it not evident that this loss of teeth does not correct or relieve a condition of malocclusion?

It might be appropriate to review an article by L. C. Broughton-Head, entitled "Observations on the Attainment of Equilibrium of Articular Consequent upon the Symmetrical Extraction of Permanent Teeth in Early Life"—presidential address to the Odonto-Chiurgical Society of Scotland, November, 1927.[5] The basis of the article is the record of about 230 cases covering a period of twenty-five years of his practice. His plan of management of malocclusion was by extraction, particularly of the bicuspids. The following tabulation is given:

| | |
|---|---|
| Number of cases treated by extraction of permanent teeth | 230 |
| Number of cases treated by the extraction of four bicuspids before the full eruption of the cuspids | 142 |
| Number of cases treated by symmetrical extraction of two bicuspids (not stated whether upper or lower) | 25 |
| Number of cases treated by a symmetrical extraction of permanent teeth, mostly for advanced caries or special reasons | 63 |
| Total | 230 |

It is stated that he does not propose to justify or defend the line of treatment adopted but has consistently dealt with nearly all cases of crowding of the teeth by means of symmetrical extraction of permanent teeth, usually first bicuspids, before the complete eruption of the permanent cuspids. By this means, it is stated, he hoped to attain his object with the minimum of after-treatment by mechanical means, to obtain a result which satisfied the parents with regard to the appearance of the child and to provide the patient with a good functional occlusion.

In studying the illustrations shown in that paper, it is evident that the results after a period of years do not justify the means. The intentional extraction, causing the early loss of teeth, has produced narrowing and shortness of the arches, but has not corrected the original symptoms, although it has modified them somewhat in some instances. Unfortunately, photographs, original and final, are not included to permit a study of the facial contour, but probably the individuals have a lack of bone development accompanying shortness and narrowing of the arches that would be manifest in an abnormal facial contour.

What is the solution of the problem? The orthodontist has the opportunity to care for those cases which are put in his hands early, for supervision of dentition or management. The larger percentage of cases are seen in time for such prevention by the dental profession, and they must take the responsibility, or if, for some reason they cannot, should refer the case to an orthodontist who will carry the responsibility. Many dentists

5. Broughton-Head, L. C.: Dent. Rec., 48: (Jan.) 1928.

well established in their practice do not feel this responsibility, and this is to be regretted; while others prefer to shift this responsibility. In all such matters, the most successful results can be obtained in the training of dental students. We have shown conclusively that this form of preventive orthodontia is sound, scientific and practical in cases in which it has been practiced. At the Children's Clinic of the University of Illinois College of Dentistry, we are carrying on a campaign for artificial space retention, in all cases in which it is indicated, and particularly in young children. The students are instructed in the principles involved in the lecture course in undergraduate orthodontia and they make a case analysis and construct and apply space retainers as a part of their clinical requirements in the Children's Clinic, under the direction of Dr. E. Gerlach, which is apart from their general infirmary clinical work. We are making more and more progress in this direction as the students see the results of their work, and also see the many cases of serious malocclusion in the orthodontia clinic that are the result of the neglect in cases of loss of teeth in the growing denture.

This study includes cases in which the loss of teeth has been recent and those in which the loss has occurred a score of years ago. The influence is usually the same, and the greater the length of time without proper management, the more serious are the conditions in the denture itself, the supporting tissues, the sinuses and the nasal passage, and the effects on the facial contour. The teaching in our professional schools a decade ago may excuse some of these conditions, but not today, and they will be less pardonable in the future. The findings of the past decade in the sciences, involving the structures and the functions of the oral and otolaryngologic regions of the human body, accompanied by clinical observations and research, are today available to the student in the curriculum of the best professional school.

In the medical group, the otolaryngologists are recognizing the relationship between orthodontia and otolaryngology. The clinical evidence accompanying respiratory and sinus disturbances and deformities points to a relationship between narrow and short arches and the early loss of teeth. In a case in which a septum resection was necessary at the age of 30 years, culminating from a series of nasal operations due to the underdevelopment of the maxilla which resulted from the symmetrical extraction of the bicuspids at the age of 12 years for the correction of a developing malocclusion, correction was not accomplished but the malocclusion was seriously increased.

My plea to the profession is for the recognition of the effects and serious consequences of the early loss of teeth. When these consequences are recognized, the importance of timely artificial space retention will be evident. The principle of restoring occlusion and maintaining a full complement of teeth by artificial means where necessary is a safe and sane procedure, and, in the end, the patient profits greatly by this recognition of the interdependence of the teeth.

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# CAVITY PREPARATION*

By RALPH R. BYRNES, D.D.S., F.A.C.D., Atlanta, Ga.

I HAVE been asked to talk on cavity preparation, as set forth by G. V. Black. The subject is so extensive that, in the limited time I have, I can simply touch on it in its most essential features. Such a talk, therefore, becomes a matter, more or less, of my personal point of view, founded on some years of teaching, as to what is most important.

Any scientific contemplation of cavity preparation must involve the three fundamentals of histology, pathology and mechanics. You will note that I purposely place mechanics last.

No scientific cavity preparation can be attained without a thorough knowledge of the structure of enamel and dentin, which, of course, carries us into the realms of histology. Enamel is composed of rods or fibers held together by an intervening cement substance. The enamel rods, in turn, are made up of globules, or little balls, held together in rows or lines. These can best be likened, in a gross way, to the result that one would obtain if he were to take small balls of putty or soft clay, and by stacking them one upon another, apply just enough pressure to make them flatten at their points of contact sufficiently to permit their standing alone. If now, several of these stacks or columns are placed in close contact, some idea may be obtained of the structure of the enamel.

The enamel rods are stronger than the cement substance which binds them together, so that, in breaking or cutting, the enamel is inclined to split along the length of the rods. This, then, would be known as its line of cleavage, a most important feature in cavity preparation.

It is surprising to what extent the general rule applies that "the direction of the enamel rods is from the center of the crown of the tooth toward the surface," or, to modify this for practical purposes, that "the enamel rods are most commonly at right angles to the surfaces on which they are found." In every tooth, there are certain portions in which the enamel rods approach the surface at more or less of an inclination from such a perpendicular. In a general way, the rods are more nearly at right angles to the surfaces at the apex of the cusps and in the central portions of the lateral surfaces of a tooth, the inclination of the rods, or the deviation from the right angle, being most marked in the slope of the cusps, around the grooves and in the cervical enamel. Study of the enamel rods is, of course, important to the operator, as the knowledge of the direction of these rods in the various areas of the teeth is the basis upon which extension of cavity margins and beveling of cavosurface angles are

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 22, 1928.

made. So much for a hasty review of the enamel rods, the application to cavity preparation to be reached later.

In taking up the great principle of extension of cavity margins for the prevention of the recurrence of caries, we must lay a foundation by a short journey into the realms of pathology.

With reference to the manner in which caries occurs, there are two great groups, namely, pit and fissure cavities, and smooth surface cavities. The former are found wherever pits and fissures occur, and the latter, as the name indicates, are found on portions of the surfaces of teeth which do not present pits or fissures for the beginning of the process of caries.

The process of caries, as far as the dentin is concerned, is identical in both of these groups, but the processes in the enamel are quite different and require different treatment in cavity preparation with reference to extension for prevention.

Pit and fissure cavities begin in pits, grooves or fissures. Here, they cover themselves with a gelatinoid substance, which makes their hiding place secure, so to speak. Their nest or nidus is thus formed, and they grow and multiply. Their acid products dissolve out the lime salts which hold the enamel rods together, and thus form a channel for the progress of the micro-organisms toward the dentin and a general undermining of the enamel beneath the surface. This undermining along the dentino-enamel junction is sometimes termed backward decay. The only evidence on the surface, of such a process, may be a darkened line in the groove, or a spot in the pit, pressure on which with a cutting instrument may cause the surface to cave in.

The process, on reaching the dentino-enamel junction, finds less resistance here than in the enamel, and the spread is more rapid. Because of the inclination of the enamel rods toward a groove or pit, we have the cone shaped decay in the enamel here, with its apex toward the surface and its base toward the pulp. The caries penetrates the dentin in the form of a cone with its apex toward the pulp, and its base toward the dentino-enamel junction. The process follows the form of a cone because the decay had its commencement in the center of the area involved at the dentino-enamel junction. The dentinal tubules being entered there first, the micro-organisms penetrate farthest because of their early start. The cone of decay is larger in the dentin than in the enamel because the dentin is preferred by the micro-organisms, is softer, etc.

In the preparation of cavities of the pit and fissure group, it is necessary only to remove the enamel covering the area undermined by caries and form the cavity in the dentin. Further extension for prevention of recurrence of caries is not necessary, except where it may be required to follow out deep grooves to places where a smooth margin may be given the filling, or restoration.

Smooth surface cavities have their beginnings in surfaces which are free from structural defects. Micro-organisms must, therefore, attach themselves to the surfaces in areas which are more or less hidden from the excursions of the food and saliva, as in the proximal surfaces and in the habitually unclean areas, left so by inadequate use of the toothbrush, as at the gingival margin of the buccal and labial surfaces. Here again, the micro-organisms collect and cover themselves with a gelatinoid substance, their

acid products dissolving out the lime salts of the enamel; but because of the difference in the inclination of the enamel rods here as compared to those surrounding a groove, the caries spreads laterally on the surface, each part of the widened area of beginning caries penetrating in the line of the length of the enamel rods. This gives a conical area of caries with the base of the cone at the surface, the apex toward the pulp. This is just the reverse of the process having its inception in the enamel surrounding a groove, fissure or pit, while the decay in the dentin is identical; or, to repeat, immediately the enamel is penetrated, caries spreads laterally along the dentino-enamel junction in every direction.

The extension of the margins of gingival third cavities from the center of the surface, far toward the mesial and distal angles of the tooth, is so necessary that the rule should be to cut them close to the angles in every case, but never past the angles. Herein alone lies safety, for if this is not done, and susceptibility to caries continues, caries is almost certain to recur at the mesial or distal aspect, or both, and the filling will be lost. Why to the angles? Because this is an area of natural immunity. I might mention that, in a record of 10,000 cases examined in the dental clinic of the Northwestern University, Chicago, only nine presented caries beginning at these angles of the tooth, and in all of these there was some natural or acquired fault of occlusion, i. e., teeth twisted, not occluding, lost or abscessed, normal use being thereby prevented.

In laying the gingival wall of a cavity, we should be guided by the age of our patient. If such cavities are filled in young persons without pushing the gingivae well back so that the margin of the cavity can be extended well under it, the natural shrinkage of the gingivae, as age advances, will expose the enamel between the gingivae and the filling.

So much for the difference in the method of spread of caries in pit and fissure cavities and in smooth surface cavities.

To some of you, grown gray in the practice of your profession, seven distinct steps in the preparation of cavities in the teeth may sound cumbersome. From my experience both as an accountant and as a dental teacher, I am most willing to subscribe to the principle that "any system is better than none." This is in no sense an apology for the one I am expounding, for if I were not satisfied with its merits, I should not teach it. I can go further and say, for the comfort of any who will adopt them, that with increased use, these steps become almost second nature. We follow their sequence without realizing it, even as we drive our automobiles. I can at this time scarcely do more than recount and give a brief explanation of each step.

The first is outline form. This, in a word, is the mental picture we form of the area to be included in the finished filling or restoration. It is the form of the area of the tooth surface to be included within the outline or enamel margin of the finished cavity. The laying out and the cutting to these lines should be the first thing considered and accomplished. Here, we first have use for our knowledge of the inclination of the enamel rods, as well as extension of cavity margins for prevention of the recurrence of caries. If the cavity is of the pit and fissure group, it means, in addition to breaking down all undermined enamel, the following out of grooves to a point where a smooth finish may be given the margin of the filling.

If one of the smooth surface group, it means the laying of cavity margins in areas of immunity or those areas kept clean by the excursions of food and saliva over their surfaces.

The second step is resistance form. This is the form given a cavity to best enable the restoration or filling to withstand the stress of mastication. It is accomplished in its highest form by combining a flat seat or floor for the filling, cut at right angles to the direction of the stress of mastication (which is usually at right angles to the long axis of the tooth), together with definite angles at the floor's junction with the surrounding walls. A round bur has no place here.

The third step is retention form, the form given a cavity to prevent the filling from being displaced by such lateral or tipping force as may be brought against it. In simple cavities, the retention form is obtained by so placing the opposing walls as to make them strictly parallel or *slightly* undercut, in order that the filling material may be firmly held in place. Retention form is required in its most perfect aspect in proximal cavities on bicuspids and molars. It is made in the form of a step cut over on the occlusal surface, in more or less the shape of a dovetail. Formerly, pits and grooves were depended on for retention form, but they have proved a delusion and a snare. The pot-leg, made usually with a round bur, has no place in modern dentistry.

The fourth step is convenience form. It represents certain modifications in a cavity which will render the form more convenient for placing the filling material. Often, by cutting a wall to a certain inclination, the plugger point will reach a given location or approach it at a more available angle, enabling the operator to pack gold more accurately and securely in certain otherwise inaccessible parts of the cavity.

A second order of convenience form consists of slight undercuts (not pot-legs) placed usually in point angles, to serve as a starting point for packing gold.

The fifth step is the removal of remaining carious dentin. First, the rubber dam should be applied; for should the pulp be exposed in the accomplishing of this step, we find ourselves in better position to master the situation and proceed in more nearly aseptic surroundings.

When this stage in cavity preparation is reached, any remaining softened dentin may be removed with large spoon excavators.

The sixth step is the finishing of the enamel walls and beveling of the cavosurface angles. If your treatment of the enamel walls thus far has been done with a proper observance of the inclination of the enamel rods, there will remain little to be done now as far as smoothing is concerned, other than running over them, with a planing motion, with a sharp chisel. When the walls have been satisfactorily smoothed, the cavosurface angle of the enamel should be cut to a distinct bevel outward, also by a planing motion with a chisel, enamel hatchet or gingival margin trimmer, used lightly. This bevel should include about one-fourth the thickness of the enamel wall, and should be at an angle of from 6 to 10 degrees centigrade from the plane of the enamel wall. The object is to cut away any loose ends of the rods, or any unsupported enamel rods which might afterwards fall away and render the margin imperfect. A second

object is to safeguard the cavosurface angle against possible checking in packing filling material. This may be done, by some, with small stones, but is not a success in my hands. With such an agent, I lose that tactile feature which is so valuable in this delicate work. If I were to use a stone at all, it would be an Arkansas stone, succeeding my cutting instruments, for I value only its polishing characteristics. Sometimes, when the walls are just right, a very fine polishing strip may be used on cavities in the anterior teeth, but this merely supplements, and does not supplant, the sharp cutting instruments.

The seventh and last step is the toilet of the cavity, consisting of freeing the cavity from chips and dust then remaining. This should be done by wiping the cavity thoroughly in all its parts with dry cotton or spunk held in the pliers. Do not use alcohol, for, after drying with the air syringe, a coating will be left on the walls. If, after all the cutting is done, moisture of any kind should enter the cavity, that portion of the same should be thoroughly dried and refreshened with the cutting instruments.

EXCAVATION OF CAVITIES BY CLASSES

As I have said, with reference to the manner in which they decay, cavities are divided into two groups, pit and fissure cavities and smooth surface cavities. Now, with reference to the similarity of treatment and instrumentation, they are divided into five classes:

Class I. Pit and fissure cavities, found wherever structural defects occur.

Class II. Proximal cavities on bicuspids and molars.

Class III. Proximal cavities on incisors and cuspids which do *not* require the removal and restoration of the incisal angle.

Class IV. Proximal cavities on incisors which *do* require the removal and restoration of the incisal angle.

Class V. Gingival third cavities (not pit cavities) occurring on the labial, buccal or lingual surfaces of the teeth.

An analysis of this classification will reveal the fact that Class I and Group 1 are identical, i. e., pit and fissure cavities; while Classes II, III, IV and V comprise Group 2, or smooth surface cavities.

To take up the preparation of a simple cavity of Class I, to be prepared in the central fossa of the occlusal surface of an upper first molar: Such a cavity should come to us with a dark spot as its only outward evidence, while examination with the aid of our exploring tine would reveal the fact that it was more or less undermined—a case of backward decay, in other words.

To obtain outline form (our first step), a round bur, 0.8 mm. in diameter, is placed in the pit while in rapid rotation, and the handpiece is swayed to and fro to engage the minute blades more readily. A fair amount of pressure is used until the bur enters the dentin. If it does not do so rapidly, it should be removed and allowed to cool. After entering the dentin, it should be removed from the handpiece and followed with a similar bur 1 mm. in diameter, the orifice being enlarged therewith.

This completes the use of the round bur, and is its only use in the excavation of these cavities. Any further opening of the cavity found necessary is obtained with inverted cone burs and hand instruments. The cavity should be extended to include the sharp slopes toward the pit without making its floor deeper. This broadening is done by undermining the enamel with an inverted cone bur, 0.8 mm. in diameter.

The undermined enamel is then chipped away with straight and bin-angle chisels and enamel hatchets, until the margins are laid in smooth areas, which is all the extension for prevention necessary on this surface, kept habitually clean by food and saliva.

In this cavity, resistance form and retention form (Steps 2 and 3) are obtained simultaneously. An inverted cone bur 1 mm. in diameter, held with its square end against the pulpal wall or floor, is carried entirely around the floor, making a sharp angle at its junction with the surrounding walls. The pulpal wall is at the same time made flat, thereby obtaining resistance form. Do not make the cavity deeper—merely broader. The cavity should be made as shallow as the removal of all caries and proper seating in the dentin will permit.

No convenience form (Step 4) is necessary as far as access is concerned, though, for a gold foil filling, one or more convenience points sunk in the surrounding walls only, not in the floor, may be necessary.

It is well to apply the rubber dam here.

In a cavity of this size, there is not likely to be need for the fifth step, the removal of remaining carious dentin, as it probably will already have been freed of caries by our previous instrumentation. If there is carious dentin remaining, it should be removed with spoon excavators.

The next, the sixth step, is the smoothing of the cavity walls and beveling of the cavosurface angles. This is done by careful paring or planing with a sharp chisel of suitable size. It should be done in the direction of the margin of the cavity or around the cavity. In such a cavity as this, the inclination of the enamel rods will be toward the cavity, and so the enamel walls may be left parallel with each other without fear that any will be left unsupported, but the cavosurface angle of the entire margin should be slightly beveled to diminish danger of fracturing of the otherwise sharp margin, in placing the filling material.

There now remains but one step, the toilet of the cavity, which, as mentioned before, consists of wiping or sweeping the cavity clear of all dust and débris.

In preparing a cavity of Class II, or a cavity on the mesial surface of a bicuspid, remember that the occlusal surface was intact when such a case developed. Remember, also, that this occlusal surface portion, or "step," represents retention form, and should not be confounded with extension for prevention, which is exemplified in the proximal portion of the cavity by laying the buccal and lingual margins in the immune areas near the axial angles of the tooth.

There are three methods of opening into an outline cavity. The first plan is to enter the distal terminus of the groove on the occlusal aspect with a bi-beveled drill 0.8 mm. in width, cutting until the dentin is reached. Enlargement is made with a larger drill or inverted cone bur. The groove is followed out toward the mesial aspect, the operator sinking the bur each time to the dentin and drawing it to the surface, until the mesial marginal ridge is cut through. This slot is enlarged until the dovetail is formed, and it has been widened and deepened sufficiently at the mesial aspect to uncover partially the decay in the mesial surface.

The second plan is to place a sharp chisel in the center of the mesial marginal ridge, inclining it first toward the

buccal, and then toward the lingual, repeatedly tapping it with a mallet until a V-shape cut is made in the ridge. This cut is enlarged by the same procedure until the cavity of the caries is reached and uncovered. A bi-beveled drill may then be placed therein and made to penetrate the dentin. The cut into the cavity may then be made with the inverted cone bur. After sufficiently enlarging this, the bur should be engaged in the dentin close to the dentino-enamel junction, and by pressing the bur distally along the line of the occlusal groove, the operator cuts the slot, and then the dovetail, in the occlusal.

The third plan is to place a separator in position, lift the teeth apart sufficiently to admit a chisel or smaller width hoe, approaching the cavity from the buccal. Its position may be gradually shifted more and more to the occlusal aspect as the enamel is chipped away closer to the marginal ridge until, finally, the enamel of the ridge itself may be chipped away by holding the instrument in the occlusal direction. An inverted cone bur may then be used for opening up the occlusal surface as in the second method. Do not make the mistake of making the occlusal step too narrow. It should occupy about one-third of the occlusal width of the tooth buccolingually. This may be done with repeated underminings with the burs and chippings with sharp chisels.

Because of the inclination of the enamel rods toward a groove, the walls in the occlusal step may be made to parallel each other in the enamel as well as in the dentin. In this position, the outer extremity of the enamel rods will be at the enamel wall of the cavity, while the other extremity will be resting in the dentin.

In cutting the proximal portion to outline form, enamel hatchets should be used to trim the overhanging enamel from the buccal and lingual walls. Often, the straight bin-angle chisels may be used for this. Then the gingival wall is cut with a scraping motion, until sound dentin is reached. The buccal and lingual walls should be cut well toward the axial angles of the tooth, their extent being determined by the width of the embrasures, and should be sloped outward in line with the inclinations of the enamel rods in this locality. If much cutting is necessary, it may be accomplished with the aid of a small inverted cone bur introduced close to the dentino-enamel junction about the center of the gingival walls, and cuts made bucally and lingually, squaring the buccogingival wall and the linguogingival angles. The bur should then be drawn toward the occlusal aspect in the dentin of both the buccal and lingual walls, thereby undermining the enamel, which is easily chipped away by introducing the chisels in the buccal and lingual embrasures.

The lingual wall should be cut so that its margin may be seen past the proximating tooth when we look across the central incisors at the median line. The buccal wall should be cut to correspond. A good test consists in cutting into the embrasures far enough just to permit of the insertion of a chisel, past the approximating tooth, from the buccal and lingual aspect, so that its flat side will be in a plane parallel with the enamel wall. It readily will be seen that this gives a flare to the buccal and lingual enamel walls, made necessary by the enamel cleavage. The strongest seating is given the restoration or filling, if the corresponding dentin walls can be made parallel. Do not cut your cavities

too deep in an effort to accentuate this. If our cutting has been correct, the gingival wall in both enamel and dentin will be on the same horizontal plane. This wall should be laid well past the original contact point, and as near the gingivae as practicable, the best results being obtained if it can be laid beneath it. Beware of leaving any chalky or etched enamel here. This junction of the gingival with the buccal and lingual walls should be sharp and definite in the dentin, but slightly, very slightly, curved in the enamel.

Resistance and retention form in this cavity require that, in the step portion of the cavity, the floor or pulpal wall shall be flat and the surroundng wall parallel, wth a slight dovetail effect in outline. In the proximal portion, the gingival wall will be horizontally flat and meet the three upright walls, i.e., axial, buccal and lingual, practically at right angles. The axial wall should meet the buccal and lingual walls at right angles in the dentin, the buccal and lingual walls being as nearly parallel as possible. Of course, the latter, in the enamel, will necessarily flare, as stated before. The squaring of all line angles (wherever two walls meet) is done with chisels and enamel hatchets.

Convenience form in this cavity is accomplished with the cutting of wedge-shaped convenience points at the gingivoaxiobuccal and gingivoaxiolingual point angles, as described before. Let me emphasize again that these are in no sense "pot-legs." They are accomplished with the smallest inverted cone bur, together with chisels or enamel hatchets. These are needed only for starting gold foil fillings, though they may not be objectionable for plastic restorations.

Any remaining caries should be removed with spoon excavators after first applying the rubber dam.

The walls now should be smoothed and the cavosurface angles beveled in all parts. Beveling is accomplished in the proximal portions with gingival margin trimmers. A careful examination of these instruments will disclose the logic of this and show how admirably they are designed for this work.

The toilet of the cavity is performed as before.

Class III includes proximal cavities on the incisors and cuspids which do not involve the removal and restoration of the incisal angle. It is not necessary to go into their preparation step by step. Take, for example, a proximal cavity on a cuspid. The cavity is given a triangular or wedge shape, with the gingival wall forming the base, while the apex is formed by the juncture, in a sharp, acute angle, of the labial and lingual walls at the incisal. The axial wall or floor meets these three surrounding walls at right angles, and, for foil fillings, convenience points are made in the surrounding walls, not in the floor, at the three corners, so to speak. The outline of the cavity in the enamel is more or less oval, not elliptical. This form in the enamel combines a knowledge of the direction of the enamel rods with an observance of the esthetic, which teaches that curves are more beautiful than straight lines.

One particular feature to which I would call attention is the laying of the labial margin well on to the labial surface. Here, we have a combination of convenience form or access, with the esthetic; for it is better to expose to view the unmistakable evidence of a good gold filling than the hidden gold filling which gives to the enamel that discolored appearance so easily mistaken

for decay or evidence of an ill-kempt mouth.

It readily can be seen that the sharp angles and convenience points in the dentin establish undercuts sufficient to make it impossible to dislodge a filling.

Class IV is, in principle, this same cavity in which the decay has progressed so far as to necessitate the removal and restoration of the incisal angle.

Take, for example, an upper incisor tooth: Here, we have a rather complicated form. As far as the proximal portion is concerned, it is prepared, as far as it goes, after the same principle as the previous cavity (the two gingival convenience points included), with the exception that there is a slight convexity of the floor or axial wall, in an effort to avoid exposure of the pulp. This makes its junction with the labial and lingual walls a little less than a right angle, or more acute. The labial and lingual walls are erected in planes which are parallel in the perpendicular, but slightly converging as they extend toward the incisal surface. This gives a secure wedge form which prevents dislodgment toward the incisal aspect, while a trench is cut in the incisal edge of the tooth between the labial and lingual enamel plates, together with a convenience point placed at the distal termination and in the floor of this slot or trench. This makes it additionally secure against tipping mesially.

In the incisal step portion, more of the lingual plate of enamel is removed than of the labial. This is because the stress of mastication is normally from the lingual in the upper anterior teeth. Were this a lower incisor, the labial plate would be sacrificed more than the lingual for the reason that the stress is just the reverse. A slightly "rounded corner" in the enamel at the junction of the proximal with the incisal portions of the cavity is desirable. This is to add strength and to prevent fracture. Also, the incisal step is cut to about the junction of the middle with the distal third of the tooth, which is the point where these respective lobes of the tooth coalesce. This is a weak line; hence, we should cut to or past it and not just nearly to it. This incisal step or slot is cut with the smallest sizes of inverted cone burs, which give at once our outline, resistance, and retention forms.

Class V comprises cavities in the gingival third, not pit cavities, of all the teeth. I am in the habit of referring to these as "filth cavities" in lecturing to my classes, a rather strong term, perhaps, but one that drives home the point that most of these could be prevented by the use of a toothbrush and water, four times a day.

So as far as the principles involved in the preparation of this class of cavities are concerned, they are simple. As far as the practical preparation of this class in the mouth is concerned, these cavities are sometimes most difficult; first, because of lack of access, and, secondly, because of extreme sensitiveness. The hand instruments will be found less painful than the burs. The first strokes are usually the most painful, but if they are well and vigorously made, most of the carious material in the central portion can be removed. This should be followed by employment of a sharp inverted cone bur 1 mm. in diameter, passed quickly around the periphery with its square end resting upon the floor or axial wall of the cavity These cavities are cut to, but not over, the angles of the teeth, which are the immune areas. The age of the patient must guide us in laying the gingival margin of these cavities. We may find

it necessary to use the square end fissure bur in squaring up the mesial and distal walls, which are liable to be too much undercut or marred by the inverted cone bur.

These cavities need almost no resistance form, except as it is included in retention form, for the reason that they are not subjected to any stress. Convenience points for starting gold foil may be used as required, the maximum number being four, one being placed at each theoretical point angle. Scarcely more than two will ever be found necessary, and often none at all, this depending upon the skill of the operator.

I have said so much about extending to immune areas that I wish to relate what happens when this practice is ignored. Take, for example, the last cavity. If the central part is cut out and filled without extension, the growth of the micro-organisms will recur on the filling and, being unable to make any impression thereon, the nidus, or nest, will spread over it mesially or distally, or both, and caries of the contiguous enamel quickly ensues.

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## DISCUSSION

*P. F. Gilbreath, Kansas City, Mo.:* There is no subject or department of dentistry that the general practitioner should have as much interest in as the subject of cavity preparation. Fads and fancies in mechanical dentistry come, and many of them soon pass, but teeth continue to decay, the most scientific skill known to the dental profession being exacted to combat its destruction and repair the lost structure. In this period of rapid progress in dental and medical research, when so many systemic ills are attributed to oral infection, owing to the death of pulp tissue, it behooves us to consider more and more the responsibility which we assume in caring for the teeth which are daily entrusted to us. We should be stimulated to exercise our best judgment and effort in repairing lost tooth structure in such a way that the individual tooth may retain its health and usefulness. No matter how well the material has been inserted in the cavity; no matter how well the filling may be finished and polished, if the formation of the cavity previous to the insertion of the filling has not been properly carried out, the filling will be a failure. No doubt, it was these conditions and apparent failures that prompted G. V. Black to burn the midnight oil in analyzing the conditions which cause dental caries, and to give his best days in working out a method of preparing the various classes of cavities that the dental profession might have some system of securing proper outline, resistance, retention and convenience form in order to guard against recurrence of caries or the dislodgment of the fillings and at the same time to make our operations more simple and on a more scientific basis. Dr. Byrnes points out the fundamentals in all scientific cavity preparation, involving histology, pathology and mechanics. It is interesting and instructive to have our minds directed for a brief period to consideration of the structure of tooth enamel and the importance of studying the enamel rods in cavity preparation, also the methods in which caries attacks the enamel and progresses into the dentin. We need to be reminded often that we are dealing with living tissue when we attempt to remove decay and prepare cavities in vital teeth. Quoting from Dr. Byrnes' paper, read at the Midwinter Clinic of the Chicago Dental Society in 1927, he says, "When a dentist removes decay, he is dealing with pathologic tissue, and his responsibility does not stop with the removal or treatment of pathologic tissue; he must replace the lost parts artificially to the best of his ability. He should realize at all times that he is dealing with a specialized body tissue, as much a part of the human anatomy as the hand or foot or the stomach. He should realize at all times that the pulp of a tooth is one of the most delicate and sensitive tissues of the body. Too many teeth are lost through careless consideration or rather inconsideration of the pulp." From Dr. Prime's paper, read before this section in 1928: "The dentist who operates on teeth and through his excessive cutting causes them to fracture or causes the pulp to die or permanently injures the gingival tissue, in any event bringing about the ultimate loss of the tooth, is comparable to a life guard who

brings in the drowning person but by reason of his severe methods so injuries him that he later dies." It so often happens that we become so completely absorbed in the mechanics of our operations that we forget all about the tissues we are cutting on. There is nothing gained in our careful mechanical restoration if the tooth itself is to be lost in a short time. We should use more skill in adapting filling materials to the requirements of the tooth, rather than to force the tooth to meet the requirements of the filling material. While there are general laws governing the preparation of all cavities, each cavity is a law unto itself, and must be studied that the general laws may be intelligently applied. I believe that susceptibility and immunity to dental caries play an important part in some cases. Such modifications are only to be considered for the tooth that we actually know by clinical experience and observation is not generally susceptible to caries. Many of the very small pit and fissure cavities come under the class of slight modification. Dr. Prime stated in his paper last year that pit and fissure cavities are the most abundant, that there are more pit and fissure cavities than all other combined. Pit and fissure cavities should be filled early, many times soon after the teeth are erupted, and should be cut only enough to follow out the fissures, and only deep enough to remove all the carious dentin and no more. Extension for prevention does not apply to these cavities. In this type of preparation, the cavities are enlarged only sufficiently to admit very small gold or amalgam pluggers. The ideal cavity preparation for the retentive and resistance form is of the box shape, and the nearer we can approach that form, the nearer we approach the ideal cavity. All cavities in all the teeth lend themselves to this form with the modifications that the anatomic formation of the tooth demands. In Class II cavities involving two or more surfaces, there are times when modification of the general rules is to be considered. We are justified in deviating slightly from the strict rules of squaring up the buccogingival and the linguogingival angle, when, by squaring these angles, we jeopardize the health of the pulp. We know that the ideal form is a flat seat, but we can rely to a large degree on the shape of the step or occlusal part of the cavity for retention and resistance for inlay operations. It is necessary to know the amount and direction of the stress that is going to fall on the finished filling in order that we may have an intelligent idea of the place, the breadth and depth of the foundation that we will lay for our building. It would be foolish and cruel to cut as widely and deeply for a cavity in a tooth that had little or no occlusion, as it would for a cavity when the filling would have to stand the stress of a vigorous occlusion. All these things must modify the rules, and as Dr. Conzett said one time in a lecture on cavity preparation, "Fit the method to the necessity and be sure that you have properly gaged the necessity." I was especially impressed by the way Dr. Byrnes explained the sixth step of cavity preparation, the finishing of the enamel walls and beveling of the cavosurface angles. There are probably more failures of fillings due to improper preparation of the enamel margins than any other part of the procedure of preparing and filling cavities. Dr. Byrnes carefully described the structure of enamel and the arrangement of the enamel rods, and he stresses the importance of knowing the direction of these rods in the various areas of the teeth. We know that the enamel is the protective organ of the tooth, and as long as the enamel is preserved, there can be no decay, for decay is always from without, and the organisms of decay must break down this wall of defense before any inroads can be made on the dentin itself. As is explained, the enamel is composed of rods and cement substance, these rods standing on end resting on the dentin, which is the strongest possible arrangement as long as they are preserved. But as soon as the cement substance is dissolved, the rods fall into a gap on the slightest pretense and weaken the adjoining rods. We know that all rods do not reach the dentin owing to the shape and curves of the tooth. It is necessary to have a number of rods on all the curved surfaces that do not reach the dentin and, as a consequence, they are much weaker than their neighbors that rest on the dentin. All such rods must be protected. Then again, we shorten many rods in our cavity preparation. In many places, the arrangement of the rods is such that a straight cut will often leave the outer portion of the rod cut off from the part that is resting on the dentin. It will not stand long in such a position, but will, under stress of mastication, fall out and leave an opening

for micro-organisms, and the consequence will be recurrence of decay. There should be no short enamel rods left exposed on the surface of the tooth adjacent to a filling. Thus, the importance of knowing something about dental anatomy and histology: that we will be able to know where to direct the cavosurface angle to avoid such recurrence of decay. As was stated, the bevel should include about one fourth the thickness of the enamel. This should be at an angle of from 6 to 10 degrees centigrade from the plane of the enamel. There are instruments that have been devised for the purpose of beveling enamel margins, and if there are any who are not familiar with these instruments, I recommend that you try them, for I believe they are the most valuable of the entire set of instruments used in cavity preparation.

# DENTAL FINDINGS IN OCULAR LESIONS*

By LOUIS M. CRUTTENDEN, D.D.S., St. Paul, Minn.

THE close relationship of ocular disease and dental disorders has been indicated for more than 100 years by reports contained in the literature. In 1887, Brubaker[1] cited several cases that had been reported from thirty-five to fifty years previously to that time, wherein the extraction of teeth had cleared up various eye conditions. These were explained as cases of reflex neuroses, but, from their description, there is every probability that they involved diseased, pulpless teeth. Satisfactory results were obtained in many of these cases, but the explanation of the process does not fit in with our present-day knowledge of this subject.

Dental conditions may cause changes in the eye which are functional and pathologic.

The functional cases are reflex neuroses which present themselves as sensory, vasomotor or muscular disorders of the eye. These types of ocular disorders are caused by stimuli along the dental tract and the impulse is carried to the eye. Black[2] says that these conditions may be caused by pressure on the terminal branches of the trigeminus and sympathetic nerves. They usually arise from vital teeth that have inflamed pulps or, more rarely, from pulp nodules or unerupted and impacted teeth. Fromaget[3] states that periapical infection can irritate the nerve terminals and cause similar conditions of the eye. Kahn[4] has men-

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1. Brubaker: Reflex Neuroses Associated with Dental Pathology, American System of Dentistry, Lea Bros. & Co. Vol. 3, p. 434, 1887.

2. Black, A. D.: Ocular Diseases Resulting from Dental Lesions, Ophth. Rec., p. 610-622, 1915.

3. Fromaget, C.: Eye Disturbances of Dental Origin, Jour. de med. de Bordeau, 104: 91-99 (Feb. 10) 1927, abst. J.A.M.A., 89: 161 (July 9) 1927.

4. Kahn, W. W.: Asthenopic Reflex Manifestations Between the Eyes and Teeth. J.A.M.A., 80: 1134 (April 24) 1923.

tioned several cases of asthenopia that have been benefited by the removal of periapically infected teeth. Dutrow[5] reports a case of paralysis of the left external rectus muscle that was restored to normal after the removal of an impacted lower third molar. The literature apparently agrees that the impacted tooth is not a causative factor of these conditions except in rare instances.

The pathologic group embraces the cases in which oral infection affects the eye. The ocular disease may manifest itself either by toxemia through systemic absorption or by metastatic infection from some remote focus. Focal infections may involve any part of the eye, but since the uveal tract, which comprises the choroid, ciliary body and the iris, contains the principal circulatory medium which nourishes the eye, it is the part most frequently involved. Several sources of infection may cause the same pathologic changes, but the most common foci are the teeth and the tonsils, and they are the easiest foci to eliminate. Formerly, syphilis and tuberculosis were the outstanding etiologic factors in diseases of the circulatory tunic of the eye; now, it is quite generally accepted that focal infection has replaced them. Syphilis is still a great factor, especially in cases admitted to free clinics, but it is not infrequent to find both conditions present, and when this is true, the elimination of various foci, as well as antisyphilitic treatment, is the usual procedure.

TABLE 1.—SUMMARY OF CASES

| | Iritis | Choroid. | Uveitis | Total |
|---|---|---|---|---|
| Number of cases | 32 | 9 | 14 | 55 |
| Males | 23 | 6 | 6 | 35 |
| Females | 9 | 3 | 8 | 20 |
| removed completely | 19 | 6 | 9 | 24 |
| Average age (years) | 35 13/16 | 36 2/3 | 37 5/14 | 36 19/35 |
| Oldest patient | .. | .. | .. | 68 |
| Youngest patient | .. | .. | .. | 18 |

Oral infection is probably carried to the eye by indirect bacterial metastasis. De Schweinitz[6] says, regarding the mechanism of focal infection as related to the developments of ocular diseases,

> The selective tissue affinity of certain bacteria, i.e., elective localization, is more than a theory, and rests in the opinion of many expert bacteriologists upon a satisfactory foundation. The objection that the bacteria come from a primary lesion which is suppurative, while the uveitis is non-suppurative, is met by the statement that the microorganisms decrease in virulence in their contact with the blood serum and they are not contained in emboli or blood clots. Although no one has proved that circulating bacterial toxins are not present, it is highly probable that in bacterial infections the germs themselves are present rather than their products as toxins and endotoxins, produced in a distant focus. Finally, as has been demonstrated by competent observers, cultures from infected teeth or pulps injected intravenously into rabbits can produce iritis.

One of the most valuable contributions to the literature in regard to focal infections and their relation to pathologic conditions of the uveal tract is the work done by Irons and Brown.[7] They report detailed etiology of 200 cases of iritis. Infection in the teeth and tonsils was found in 42 per cent of the cases, tonsillar infection constituting 26 per cent, while dental infection was present in 16 per cent. Syphilis was a factor in 19 per cent, while 4 per cent of the

5. Dutrow: Report of a Case of Reflex Ocular Disturbance Due to Impacted Third Molars, Ophth. Rec., p. 253, 1915.

6. De Schweinitz, J. E.: Dental Sepsis in Its Relation to Ocular Disorders, Dent. Cosmos, 62: 565 (May) 1920.

7. Irons, E. E., and Brown, E. V. L.: Etiology of Iritis, J.A.M.A., 64: 1840 (June 10) 1916; 81: 1770 (Nov. 24) 1923.

TABLE 2.—IRITIS

| No. | Sex | Age | Dental | | | | | Nose and Throat | Other Infections | Wass. Test | Results |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pulpless Teeth | | | Pyor. | Treatment | | | | |
| | | | Des. | Cons. | Neg. | | | | | | |
| 1 | F | 30 | 2 | 1 | | | | Tonsils + | Congenital syphilis | Neg. | No follow up |
| 2 | M | 24 | | | | | | Tonsils + operated | | Neg. | Well |
| 3 | M | 39 | 3 | | | | Removed 3 | Tonsils + operated | | Neg. | Improved |
| 4 | M | 36 | 7 | | | | Removed 9 | Tonsils + operated | | Neg. | Improved |
| 5 | M | 21 | 1 | | | | | Tonsils not examined | | Pos. | No follow up |
| 6 | M | 39 | 1 | 1 | | I | Removed 2 treated | Tonsils + | | Neg. | Well |
| 7 | M | 42 | | | | | | Neg. | | Neg. | No change |
| 8 | M | 32 | | | 6 | | Removed all teeth | Tonsils out | Prostate + (non ven.) | Neg. | No change |
| 9 | F | 41 | | | | II (I) | Removed 1 | Tonsils out | Diabetes | Neg. | Improved |
| 10 | M | 42 | 1 | | | II | Treated | Tonsils out | Prostate + | Neg. | Well |
| 11 | M | 39 | 1 | | | I | | Tonsils + | | Neg. | Well |
| 12 | M | 59 | 1 | | 1 | | Removed 4 | Tonsils + operated | | Neg. | Well |
| 13 | M | 24 | | | | | | Tonsils neg. | | Neg. | Well |
| 14 | M | 37 | | | | | | Tonsils out | | Neg. | Well |
| 15 | M | 20 | 2 | | | | Removed 2 | Tonsils out | | Neg. | No change |
| 16 | M | 39 | | | 1 | | Removed 1 | Tonsils tag | | Neg. | No change |
| 17 | M | 30 | 3 | | 1 | III | Removed 9 | Tonsils out | | Neg. | Improved |
| 18 | F | 30 | | | 1 | | Removed 2 | Neg. | | Neg. | No change |
| 19 | M | 27 | 1 | | 1 | | Removed 2 | Neg. | | Neg. | Improved |
| 20 | M | 44 | 1 | | 1 | | Removed 3 | Tonsils + | | Neg. | Improved |
| 21 | F | 37 | | | | | | Tonsils + operated | | Neg. | Cataract complication |
| 22 | M | 34 | 1 | | 2 | | Removed 3 | Tonsils tag | | Neg. | Well |
| 23 | M | 24 | | | | | | Tonsils + | | Neg. | Improved |
| 24 | M | 60 | 1 | | | | Removed 1 | | | Neg. | Improved |
| 25 | F | 18 | 1 Acute | | 1 | | Removed 2 | Neg. | | Neg. | Improved |
| 26 | F | 35 | 2 | | | | Removed 2 | Tonsils out sinusitis | | Neg. | Improved |
| 27 | F | 52 | | | | III | Removed 9 | Tonsils + | | Pos. | Improved |
| 28 | M | 30 | | | | I | Treated | Neg. | Herpetic origin | Not taken | Well |
| 29 | M | 36 | | | | | | | T. B. and trauma | Neg. | Improved |
| 30 | F | 38 | 3 | | | | | Tonsils out | | Neg. | No change |
| 31 | M | 40 | 3 | 3 | 1 | III | Removed 10 | | | Neg. | Well |
| 32 | F | 40 | | | 2 | | | Tonsils out | | Neg. | No change |

patients had tuberculosis. Later,[8] they reported a follow-up on fifty of these cases covering from three to twelve years. Forty-three patients had no further trouble, seven had recurrences with unfavorable results; but of those patients showing favorable results, 37 per cent had had their tonsils removed and 30 per cent had their diseased teeth extracted. Thus, 67 per cent were benefited by elimination of infection from the throat and mouth. This very careful study by Irons and Brown has been accepted by ophthalmologists as the strongest argument that mouth and throat infection constitutes the largest etiologic factor in diseases involving the uveal structure of the eye. This establishes focal infection as a large etiologic factor in diseases of the eye of toxic origin. Many of their series were from clinics where the percentage of syphilis is higher than in private practice, which accounts for a relatively high percentage of syphilis in the series.

Dental infection enters the system through the pulp canal of the tooth and around the tooth by destroying its pericemental membrane. Opthalmologists differ in their opinion regarding which does the greatest damage. Bedell[9] feels that the periapical infection is the greatest source of infection and that pyorrhea is not much of a factor unless it is very severe. Finoff[10] thinks that pyorrhea is

TABLE 3.—UVEITIS

| No. | Sex | Age | Dental | | | | | Nose and Throat | Other Infections | Wass. Test | Results |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pulpless Teeth | | | Pyor. | Treatment | | | | |
| | | | Des. | Cons. | Neg. | | | | | | |
| 33 | M | 47 | 2 | | | | Removed 8 | Tonsils + | | Neg. | Improved |
| 34 | M | 49 | | | | | Yes Removed 3 | Tonsils + operated | Prostate + | Neg. | Improved |
| 35 | M | 53 | 2 | | 1 Root | | Removed 3 | Tonsils + | | Neg. | No change |
| 36 | F | 18 | 1 | | | | Removed 1 | Tonsils + operated | T.B. suspect | Neg. | Improved |
| 37 | M | 48 | 3 | | | | Removed 3 | Antritis, tons. + oper. | Prostate + | Neg. | Improved |
| 38 | F | 29 | | | | | | Tonsils + operated | | Neg. | Improved |
| 39 | F | 32 | 1 | | 1 | | Removed 2 | | Ovarian cys. removed | Neg. | Improved |
| 40 | F | 48 | 1 | | 2 | | Removed 3 | Tonsils + operated | | Neg. | Improved |
| 41 | M | 45 | | | 2 | | | | | | No change |
| 42 | F | 25 | | | 3 | | | Neg. | | Neg. | Improved |
| 43 | F | 36 | | | 1 Root | | Removed 1 | Tonsils + operated | | Neg. | Improved |
| 44 | F | 31 | | | 2 | | | Tonsils + operated | | Neg. | Well |
| 45 | F | 23 | | | | | | Neg. | | Neg. | Well |
| 46 | M | 39 | 6 | | 5 | | Removed 14 | Antritis | | Neg. | Improved |

8. Irons, E. E., and Brown, E. V. L.: Recurrence of Iritis as Influenced by the Removal of Infections; Summary of Fifty Cases, J.A.M.A., 87: 1167 (Oct. 9) 1926.

9. Bedell, A. J.: Relation of Eyes and Teeth, Dent. Cosmos, 67: 990-997 (Oct.) 1925.

10. Finoff: Relation of Mouth to Ocular Diseases, Ann. Ophth., 26: 66, 1917.

the greatest offender in the oral field. Ulrich[11] reported positive bacterial cultures from apices of pulpless teeth in 68 per cent, while many other workers report even higher percentages. Keilty[12] concludes, in his extensive work on gingivitis, that "the gingivæ, the seat of gingivitis, offer the largest and most important single portal of entry for micro-ocular infections. When the gums are inflamed and spongy, they are likewise a source of infection, and if the condition cannot be cleared up by treatment, the more radical therapy of removing the teeth surrounding these areas should be employed.

Cases tabulated for this paper comprise only those in which the uveal tract

TABLE 4.—CHOROIDITIS

| No. | Sex | Age | Dental | | | | | Nose and Throat | Other Infections | Wass. Test | Results |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pulpless Teeth | | | Pyor. | Treatment | | | | |
| | | | Des. | Cons. | Neg. | | | | | | |
| 47 | M | 32 | 3 | | | II(I) | Removed 4 | Tonsils tag operated | | Neg. | No change |
| 48 | M | 42 | | | 1 | | Removed 1 | Tonsils + operated | Prostate (non ven.) | Neg. | Improved |
| 49 | F | 33 | 3 | | | | Removed 5 | Tonsils out | Tuberculous | Neg. | Improved |
| 50 | F | 44 | | | | I | | Neg. | Tuberculous | Neg. | Well |
| 51 | M | 27 | | | 1 | | | | | | Improved |
| 52 | M | 45 | 2 | 1 | | | Removed 3 | | | | Well |
| 53 | M | 38 | | | | | | Tonsils + | | Neg. | No change |
| 54 | M | 40 | 2 | | | I | Removed 2 | Tonsils + operated | G. U. Neg. G. C. Hist. | Neg. | Improved |
| 55 | F | 29 | 1 | | | | Removed 1 | Tonsils tag operated | Tuberculous pelvic infect. | Neg. | Improved |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

organisms and as such are the most potential sources of foci of infection in the body." A vast amount of evidence indicates that most pulpless teeth are infected, and consequently they have no place in the mouths of patients suffering with

11. Ulrich: Focal Infection with Special Reference to Oral Sepsis, J.A.M.A., Nov. 6, 1915.

12. Keilty, R. A.: Present State of Our Knowledge of Gingivitis, J. Lab. & Clin. Med., 13: 451 (Feb.) 1928.

was involved. Each patient was put through a very rigid clinical examination in search for every possible focus of infection. This included a dental examination, with complete roentgenograms of the entire mouth, clinical examination and vitality tests of any questionable teeth. In all cases, the extraction of all pulpless teeth and all hopelessly diseased teeth was advised. This advice was accepted by thirty-four out

of the forty-five patients who had some form of dental infection. An attempt is made to present detailed roentgen-ray and clinical findings in each case. The roentgen-ray classification is arbitrarily divided into three classes: (1) pulpless teeth that showed definite periapical destruction; (2) pulpless teeth that showed some form of construction

TABLE 5.—SUMMARY OF CASES

| | Iritis | Choroid. | Uveitis | Total |
|---|---|---|---|---|
| Cases dental infection | 25 | 8 | 12 | 45 |
| Cases nose and throat infection | 14 | 5 | 10 | 29 |
| Cases positive Wasserman reaction | 2 | 0 | 0 | 2 |
| Cases all other infections | 4 | 5 | 4 | 13 |
| Cases dental infection removed completely | 19 | 6 | 9 | 34 |
| Cases nose and throat infection removed | 6 | 4 | 8 | 18 |

TABLE 6.—DENTAL ROENTGEN-RAY FINDINGS IN PULPLESS TEETH

| | Iritis | Choroid. | Uveitis | Total |
|---|---|---|---|---|
| Destruction alone | 7 | 2 | 2 | 11 |
| Construction alone | 0 | 0 | 0 | 0 |
| Negative alone | 4 | 2 | 4 | 10 |
| Destruction and construction | 3 | 1 | 0 | 4 |
| Destruction and negative | 6 | 0 | 4 | 10 |
| Pyorrhea alone | 3 | 1 | 1 | 5 |
| Pyorrhea and pulpless teeth | 10 | 3 | 4 | 17 |

TABLE 7.—DEGREE OF DENTAL INFECTION

| | Iritis | Choroid. | Uveitis | Total |
|---|---|---|---|---|
| Dental infection, I | 3 | 2 | 5 | 10 |
| Dental infection, II | 12 | 3 | 3 | 18 |
| Dental infection, III | 10 | 3 | 4 | 17 |

as hypercementosis and condensed periapical areas, and (3) the so-called roentgen-ray negative pulpless teeth, or those that showed no apparent periapical change. The pyorrhea teeth were divided into three classes according to their degree of severity and the number involved.

It is conceded that all diseases of the uveal tract may not be toxic in their origin; in fact, in some cases the origin is unknown. In this series, 77 per cent of follow-up cases showed improvement after the foci of infection were eliminated. Syphilis was present in only 5 per cent of cases, and this comparatively low figure is accounted for by the fact that these cases were all from private practice. Eighty-two per cent of the entire series had dental infection in some form, either alone or combined with some other infection. Some form of nose and throat infection, but chiefly tonsillar, was present in 53 per cent of all cases. Practically complete removal of dental infection was accomplished for 79 per cent of patients in whom it existed; 62 per cent of the nose and throat cases were treated for existing infection.

TABLE 8.—SUMMARY OF RESULTS

| | Iritis | Choroid. | Uveitis | Total |
|---|---|---|---|---|
| Cases reported as well | 10 | 2 | 2 | 14 |
| Cases reported as improved | 12 | 5 | 10 | 27 |
| Cases reported as no change | 8 | 2 | 2 | 12 |
| Cases not reporting | 2 | 0 | 0 | 2 |

TABLE 9.—CASES REPORTED AS WELL

| | Iritis | Choroid. | Uveitis | Total |
|---|---|---|---|---|
| Dental infection alone removed | 4 | 1 | 0 | 5 |
| Dental infection and nose and throat infection removed | 1 | 0 | 0 | 1 |
| Nose and throat infection removed | 1 | 0 | 1 | 2 |
| Dental infection and all other infections removed | 1 | 1 | 0 | 2 |
| No infection found | 2 | 0 | 1 | 3 |
| Infection present but not removed | 1 | 0 | 0 | 1 |

This report would indicate that, by the elimination of the various foci of infection, the ocular condition should improve. Unfortunately, this happy result is not always obtained. A review of the series will reveal some cases in which

much infection present was eliminated but the end-result in the eye was unfavorable.

### REPORT OF CASES

CASE 1.—*Iritis.*—Vision had been lost in one eye. The tonsils had been removed and a nonvenereal prostatic infection was cleared up by treatment. The only other possible focus of infection found was six pulpless teeth, which were roentgen-ray negative for periapical infection. These, together with a few remaining teeth, were removed. This case went on to an unfavorable end.

In contrast to this case is one in which no evidence of existing infection could be found but the patient improved under general hygienic and constructive measures.

CASE 2.—*Iritis (Recurrent).*—Vision was gone in one eye. The tonsils had previously been removed. All the teeth were normal and the general physical examination was entirely negative. This patient had had every recurrence after ordinary dental work was done. This case went on to a successful recovery.

Theoretically, to determine the value of any specific line of treatment, a control group should follow with the series reported. In these types of cases, this is not practical, because both patient and ophthalmologist wish to use every agency at their disposal, not relying on a single line of treatment which might fail and result in loss of vision. Moreover, the virulence of the infection and the resistance of the individual play a large part in each individual case.

CASE 3.—*Iritis.*—One pulpless tooth present showed a slight periapical change in the roentgenogram. This tooth had been devitalized a short time previously and crowned to support a partial denture. In order to conserve the denture, an apicoectomy was performed by the patient's dentist. The iritis became worse, but disappeared immediately after the removal of this tooth.

In some cases, the removal of the foci of infection is not always complete. This many times produces failures.

CASE 4.—*Iritis.*—The patient had seven pulpless teeth, all of which showed periapical destruction in the roentgenogram. These were removed, and the iritis subsided. On a recurrence a year later, the tonsils were removed, and the eye has been clear since that time.

Case 5, an iritis, and Case 6, a uveitis, are typical cases with a great amount of oral sepsis, which have remained in good condition since the teeth were removed.

Removal of foci of infection for uveitis is not universally successful, yet the percentage of successes is high enough to indicate that the ophthalmologist has been greatly aided in the treatment of patients by adopting this line of treatment. In order to conduct a thorough search for infection, the ophthalmologist must depend on the opinions of the in-

TABLE 10.—CASES REPORTED AS IMPROVED

| | Iritis | Choroid. | Uveitis | Total |
|---|---|---|---|---|
| Dental infection removed ..... | 6 | 1 | 2 | 9 |
| Dental infection and nose and throat infection removed... | 3 | 0 | 3 | 6 |
| Dental infection and all other infection removed ..... | 1 | 4 | 4 | 9 |
| No infection found.. | 0 | 0 | 1 | 1 |
| Infection present but not removed..... | 2 | 0 | 0 | 2 |

TABLE 11.—CASES REPORTED AS NO CHANGE

| | Iritis | Choroid. | Uveitis | Total |
|---|---|---|---|---|
| Dental infection removed ..... | 5 | 0 | 1 | 6 |
| Dental infection and nose and throat infection removed... | 0 | 1 | 0 | 1 |
| Nose and throat infection removed... | 1 | 0 | 0 | 1 |
| Dental infection and all other infections removed ..... | 1 | 0 | 0 | 1 |
| No infection found.. | 1 | 0 | 0 | 1 |
| Infection present but not removed..... | 0 | 1 | 1 | 2 |

ternist, the rhinologist, the urologist and the dentist. These opinions are based upon ability to conduct a careful examination in each respective field. If the dentist utilizes all the agencies available, roentgen-ray, vitality and transillumination tests, and a careful clinical examination, he is able to render an accurate report. The interpretation of good dental roentgenograms and the advice given form the basis of his report to the clinician, from which the ophthalmologist must also form an opinion. It therefore becomes imperative, in all cases of this type sent for dental investigation, to use every means available to determine the condition of the oral cavity.

In this series, the roentgen-ray revealed that 73 per cent of cases of pulpless teeth showed definite periapical destruction. Thirty-one per cent of cases showed evidence of pyorrhea in some form. Nine per cent of cases showed hypercementosis of the pulpless teeth. Twenty-two per cent showed pulpless teeth without apparent periapical change in the tissues. This should clearly indicate that the pulpless tooth is the greatest factor for infection in the dental field.

## CONCLUSIONS

1. Focal infection is a large etiologic factor in lesions of the uveal tract of the eye.

2. Dental and tonsillar infections comprise the greatest group causing these conditions.

3. Pulpless teeth cause the most cases of infection within the dental tract.

4. Roentgen-ray findings in pulpless teeth reveal that the greatest number show definite periapical destruction.

5. Every available diagnostic means should be utilized in rendering a report of the dental conditions in these cases.

6. Until there has been more investigation, all pulpless teeth and hopelessly diseased teeth should be removed in cases of uveal tract disease.[13]

## DISCUSSION

*Weston A. Price, Cleveland, Ohio:* When the checks were made, was an observation made, associating the elective position of the organisms in these teeth with the percentage of patients that showed the infection to be related to the teeth—I mean the cultures?

*Dr. Cruttenden:* No, that was not done. We did not feel we had enough material to do it. I merely report what the roentgen-ray findings are in our final result.

*Dr. Price:* It is rather interesting that the figures in this table should be within 10 per cent of the figures for animal lesions, from the general run of dental infections where the patients have ocular lesions. It is also very clear that many of these cases occur where the dental infection does not produce lesions in animals.

13. The writer wishes to express his gratitude to Dr. F. E. Burch for permission to examine his cases.

# HAND CARVED TEETH IN CONJUNCTION WITH PLATE WORK

By HERBERT A. LICHTENSTEIN, D.M.D., Bangor, Maine

IT IS an undisputed fact that the continuous gum denture stands supreme as far as the esthetic appearance is concerned. There are, however, several reasons why the all porcelain plate is impractical for the general practitioner. Not only is it comparatively difficult to construct a continuous gum plate, but also the price of such a restoration is prohibitive for the majority of patients. The weight of a continuous gum plate limits the use of this type of restoration to selected cases. Moreover, the repair of a plate constructed according to the present technic is a problem not to be regarded lightly. If repair is necessitated, the plate has to be subjected to a repeated baking, which, if high-fusing porcelain is used, decreases the strength of the porcelain appreciably. If a lower fusing porcelain is used for repair, the repaired portion of the plate will represent a *locus minoris resistentiae*.

While the vulcanite teeth now available answer all reasonable demands as to strength and practicability, it may be stated with little fear of contradiction that shape and color of the stock teeth allow much to be desired as yet. They bear the earmarks of the standardized product, which is an undesirable feature in the restoration of individual teeth. Grinding and staining help some, but do not eliminate this objectionable characteristic of stock teeth. There is also the danger of exaggerating the staining. A stain should be used with discretion and should distract from and not attract attention to the restoration in question. Another undesirable quality in stock teeth is their extremely high glaze, which, I am well aware, is necessary for storing and handling the teeth without danger of contracting specks and other impurities, but which makes the teeth appear artificial in a great many cases.

I shall try to describe a technic for the making of a set which is supplied with hand carved anterior teeth. The technic if adhered to is comparatively simple, and the finished product thoroughly practical, strong and, compared to the continuous gum plate, inexpensive. The restoration combines the beauty of the continuous gum denture with the advantages of vulcanite and metal plates.

The case described represents a full upper plate. One snap impression with compound, a correctible impression and an impression of the opposing teeth are necessary. A trial plate with bite-block is made on the model gained from the snap impression, and central relationship in the mouth is secured by the known methods.

The case is then mounted in an ordinary articulator and the set screw adjusted so as to maintain the proper distance from the upper model to the lower

without the support of the bite rim. The six front teeth are now carved in pink base wax on the ridge of the upper model. The carving may be done roughly but should be executed both labially and palatally so as to present the size and shape desired. (Figs. 1 and 2.) This is important, as the following technic will show. The teeth are now removed from the ridge singly and each one is provided with a hole from the base. The hole can be made with a fissure bur or a heated piece of wire. The teeth are then fastened to the model with a hot instrument and a little additional wax. The wax teeth and the model are now oiled and an impression is taken with soluble plaster. The impression is removed from the model and brass pins are inserted into the holes previously made. (Fig. 3.) The impression is now poured

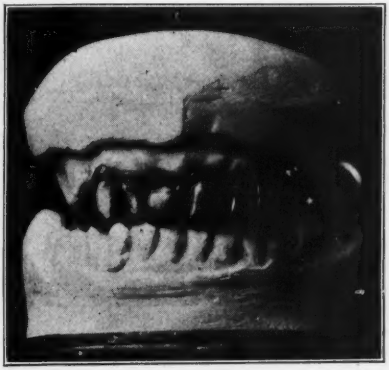

Fig. 1.—Teeth carved in pink base wax.

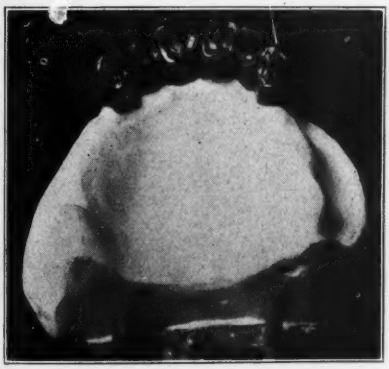

Fig. 2.—Palatal view of teeth shown in Figure 1.

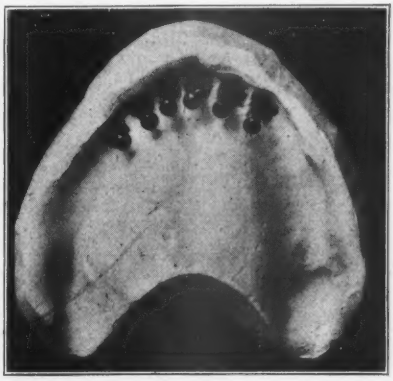

Fig. 3.—Soluble plaster impression of model shown in Figure 2, showing bases of wax teeth with inserted brass pins.

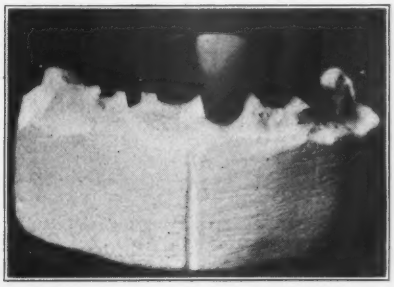

Fig. 4.—Model gained from impression shown in Figure 3, showing posts, three wax teeth and one porcelain tooth, with casting wax base underneath.

and the model liberated from it. The soluble plaster, being softer than regular Plaster of paris, can be cut off the model without injury to the wax teeth. The latter are now cleaned from the adhering plaster with a toothbrush dipped in alcohol.

Figure 4 shows the model with the wax teeth. Some of the teeth are removed to display the posts which are

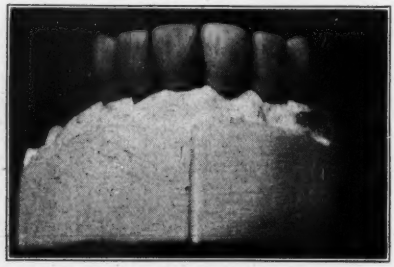

Fig. 5.—All anterior teeth after the second baking. The space between the ridge and the bases of the teeth may be noted.

Fig. 6.—Tray for baking anterior teeth.

firmly embedded in the plaster model. Using platinum foil, one-thousandth of an inch, tubes are now made over a piece of stiff wire the diameter of which should be slightly greater than that of the posts. The length of the tubes should be about 1 mm. less than the posts. One of the wax teeth is now removed, and a small piece of thin sheet casting wax is pressed over the post and adapted to the ridge, where it is fastened with a hot spatula. The wax, which is to be slightly oiled, not only facilitates the removal of the carved tooth, but provides also for a space between ridge and tooth which will be slightly increased by the shrinkage taking place during the firing process. (Fig. 4.) High fusing porcelain is now packed around the tube which was fitted over the post, and a tooth is carved. The remaining wax

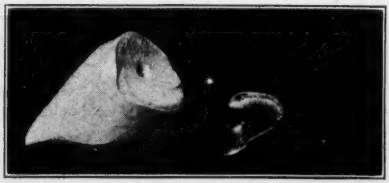

Fig. 7.—Gold socket with post and dovetail anchorage cast in one piece.

Fig. 8.—Model gained from correctible impression with trial bite-plate. The anterior part of the bite-block is trimmed away and an opening cut in the anterior portion of the plate to facilitate the waxing of the dovetails. Only half the opening is filled with sheet casting wax for demonstration purposes.

teeth serve as a guide as to shape and size. The process is repeated with each tooth until all six anteriors are carved. (Fig. 5.)

I prefer the Bridge selection of eight colors blended by Dr. G. W. Bridge. The use of Bridge's selection takes the dread of color selection out of porcelain work. More than that, it provides an ample variety of shades, and the colors can be blended not according to a stock shade guide but according to the true tooth colors. The process of making a shade guide for color selection is exceedingly simple if one uses the aluminum model provided for this purpose. This model and all necessary instruments are put up in the Bridge outfit for beginners in porcelain work.

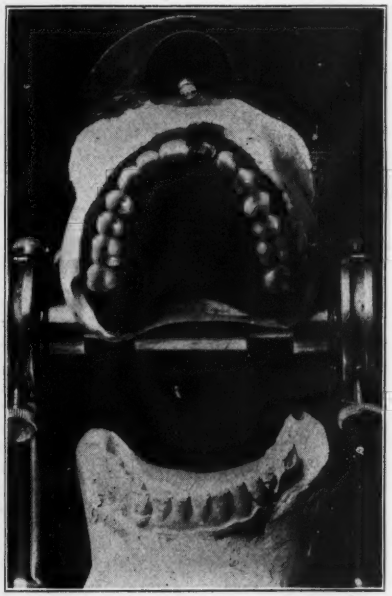

Fig. 9.—Final set-up in anatomic articulator (Wadsworth). One central incisor is removed to show anchorage.

The six teeth are now placed on a fire clay tray, which is covered with coarse silex and baked.

With the help of a small amount of fire clay powder (to be mixed with water) and some discarded iridioplatinum injection needles, a tray similar to the one shown (Fig. 6) can be made. A regular fire clay tray serves as a base. The platinum posts will carry the teeth, thereby preventing their falling off the tray and keeping them separate. After the teeth are removed from the furnace and cooled off, they are replaced on their posts on the model. Previously to this, the small wax bases are cleaned of adhering porcelain powder and slightly oiled anew.

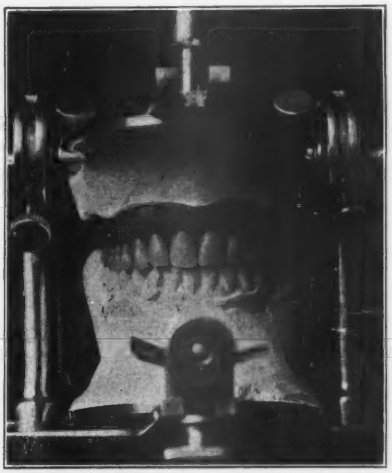

Fig. 10.—Labial view of Figure 9. The central has been replaced for trial.

The teeth are now fully carved, body being used on the marginal third and enamel for the rest of the tooth. The teeth are removed and rebaked, the temperature being carried to 2,300 F. After cooling, the teeth are smoothed and ground to shape with a white Miller stone and a generous amount of cocoa butter. The teeth are now washed with

hot water and a stiff brush, dried and set up in the plain articulator. Trying in will show any errors which can be corrected by the addition of porcelain or by grinding. It is unnecessary to mention that the teeth may be stained to an extent determined by the requirements of the case and the judgment of the operator. After being tried in, the teeth are removed from the trial plate and the wax is boiled off in a large test tube and put into the furnace for the final glaze. It may be well to remember that a slightly underglazed tooth is not only considered stronger but also has a more lifelike appearance. This may be made a point of controversy, and the operator may exercise his own judgment.

Fig. 11.—Finished denture (palatal view).

A bite-plate is now made on the model gained from our correctible impression and bite, and face-bow measurements are secured from the patient. The lower model may be knocked off the plain articulator and used again. The bite-blocks models and face-bow measurements are now transferred to an anatomic articulator.

The glazed teeth still contain their platinum tubes, which should be peeled out with strong college pliers.

It is necessary to make an attachment for each tooth in order to attain secure anchorage in the vulcanite plate.

We use thin sheet casting wax and wax posts to make the wax pattern for a socket, as shown in Figure 7. The dovetail should be fitted on the model and fastened to the socket with a hot instrument. The pattern is invested and cast with a rigid gold used for cast partial dentures. After the completion of the casting, the teeth are fitted into their sockets. The teeth are now ready for the final set-up. To facilitate this, the anterior portion of the bite-block is cut away and the part of the trial plate covering the anterior ridge is cut out, as illustrated in Figure 8. A fissure bur is the best instrument for this operation. The thus prepared bite-plate is replaced on the model and the opening is filled

Fig. 12.—Labial view of denture shown in Figure 11.

Fig. 13.—Denture in situ.

with a layer of sheet casting wax, the edges of which have to be sealed to the trial plate with a hot spatula and a little sticky wax. The teeth are now set up, stock teeth being used for the posterior teeth. (Figs. 9 and 10.) The case is now tried in, flasked and packed and after vulcanization, finishing and polishing, the teeth are cemented. It is well to oil the polished parts of the plate in order to make the removal of the cement surplus easier. In the case illustrated, a porcelite front was used. A porcelain front may be desirable in cases in which the gums are exposed in speaking or smiling. If porcelain gums are desired, the posts have to be made shorter and have to be set parallel to enable removal of the whole block from the model without breaking the former. The porcelain gum should be applied after the second baking and each tooth baked with its gum portion separately, in order to compensate for shrinkage. The teeth with their porcelain aprons are replaced on the model, the spaces are filled out with porcelain and the final pink layer is applied. One has to exercise the greatest care to remove the whole block without breaking. The block is baked and glazed and one large socket supplies the anchorage in the plate.

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# PULP CONSERVATION IN RESTORATIVE DENTISTRY*

By O. DE FOREST DAVIS, D.D.S., Cleveland, Ohio

DURING the past fifteen or twenty years, the pulpless tooth has occupied a prominent place in the discussions of both the medical and the dental profession. Although this discussion has been quite enlightening, the exact status of the pulpless tooth has not yet been agreed on. The two professions might be said now to be divided into two groups, i. e., the 100 percenters and those who will listen to reason. The latter group probably contains many men who occasionally remove a vital pulp or treat an infected tooth in the expectation that it may be made a safe and healthy member of the dental mechanism. This definite division among us is a healthy sign because it indicates progress away from the old position where the pulpless tooth was accepted as a matter of course, with no realization of its danger.

I believe that there is one question on which we can all agree, and that is that a vital tooth is far more desirable from every standpoint than a pulpless one. We will also agree that many things can be done to prevent the loss of tooth vitality. If this is true, why would it not be a wise procedure to spend less time studying the root canal operation and more time learning to prevent the loss of tooth vitality?

*Read before the Section on Partial Denture Prosthesis at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 22, 1928.

It is not the purpose of this paper to introduce any new principle or method, but merely to stress again the fact that many teeth become pulpless through preventable causes, and to urge greater consideration for the vitality of the teeth on which we operate.

I need hardly mention the research work which has been done, notably by the Mayo Clinic, demonstrating that pulpless teeth may often become a deciding factor in a fight for the recovery of health or even for life itself. This work has demonstrated an intimate relationship between infected teeth and heart lesions, stomach ulcers, kidney infections, arthritis and other chronic disorders. So much emphasis has been put on the harm which can be done to the general health by infected teeth that many dentists prefer to take no chances and advise the removal of all pulpless teeth regardless of whether the roentgenray shows any definite evidence of infection. This may seem a rather drastic procedure to many, but at least we can say that every tooth which does not contain a live healthy pulp is a potential menace to health. Under these circumstances, the dentist is offered no more important problem than that of preserving the life of the tooth.

The zeal for mechanical perfection, which modern dental training tends to develop, should not cause us to overlook the fact that the dental pulp is an organ of low recuperative power, and that injury to it, even though slight or accidental, may result in its death. It has been my observation that many of us fail to realize during the course of our mechanical operations how easy it is to cause a hyperemia which, at first, may be mild, but can ultimately cause the pulp to die. I am speaking particularly of the tooth which is sensitive after a bridge or inlay has been placed.

According to Black,[1] hyperemia of the pulp consists in the expansion of the blood vessels, especially of the arteries, during any sudden abnormal blood pressure. He holds that hyperemia itself is not a disease, but a symptom, and that only when it approaches stasis does it become a pathologic condition. He would define pathologic hyperemia as an "extraordinary excitation in which the function is forced beyond normal limits." A physiologic hyperemia of the pulp, which is a normal occurrence, is brought about by an inrush of blood to the pulp, because of the change in blood pressure, when there is a sudden change in the temperature. This may cause pain which lasts only an instant. It is when this function goes beyond normal limits that the condition becomes pathologic.

Black cites a number of causes of hyperemia. He says:

> Irritation of the dentinal fibrils in the beginning of caries seems sometimes to render the pulp more excitable, and may serve to precipitate a case of hyperemia. This occurs most frequently as a result of broad gingival third decays in the buccal surfaces of the bicuspids or molars, or in the labial surfaces of the incisors in which the end of many dentinal fibrils are laid bare.

Speaking of other causes of hyperemia, Black says:

> It is very commonly the result of heat, generated in polishing fillings, either by rapidly revolving discs or by the vigorous drawing of tapes back and forth on proximal surfaces. A filling which is placed over a nearly exposed pulp may cause hyperemia by the rapid conduction of thermal changes. A very large filling may cause a hyperemia on account of the broad contact of its inner surfaces with many dentinal tubules, even though the changes of temperature in the mouth are not extreme. The grinding away of the enamel of a vital

tooth will often cause hyperemia, either on account of the heat, or by the irritation of the end of the dentinal fibrils at the dentino-enamel junction, even though the tooth is kept cool by a jet of water or otherwise. In the so-called oral prophylaxis treatment, of the more radical nature advocated by some, in which portions of the enamel whether decayed or not are ground away to make it smooth, a very definite hyperemia will result in many cases and this should always be a warning that the vitality of the tooth is endangered. I have sometimes created hyperemia in testing teeth to determine the vitality of the pulp by applying guttapercha which was too hot. This produced severe pain at the moment and the teeth were hypersensitive for some time afterward.

From observation in my own practice and in the practice of other dentists, I have come to the conclusion that improper care during operative procedure is one of the commonest causes of injury to the pulp. There are a number of places in our procedures where a fatal injury may result because of poor execution. For instance, if the dentin is not protected from saliva while the inlay is being made, bacterial invasion of the dental tubuli will take place. Irritation of the pulp may be caused by too radical cutting of tooth structure in preparation for restorations. Failure to use a therapeutic lining under a cement base in deep-seated cavities may endanger the tooth. Compression of the dentin by tight-fitting inlays, especially in deep-seated cavities, may cause injury to the pulp. Grinding with dull burs without using water or air for cooling may result in thermal shock; while mechanical shock may be caused by grinding with untrue or very coarse stones.

While every dentist has undoubtedly developed in his practice methods of attaining the objects that I have mentioned, I wish to present a few methods which have proved quite satisfactory in my hands as well as in the hands of others that I have observed.

1. Thermal shock is one of the commonest sources of irritation to the pulp, although one of the easiest to avoid. It is usually caused by the use of dull burs or stones without the use of water to keep the tooth cool. A new bur will become dull very quickly when cutting sound tooth structure. For this reason, a bur should not be used in the mouth a second time except when cutting soft materials such as amalgam or cement. I find that the most careful operators use new burs exclusively.

2. Mechanical shock may result from grinding with an untrue stone. Besides being a distinct irritation to the tooth, it is most annoying to the patient. The stone revolves at several thousand revolutions a minute, and if it is not perfectly true, the tooth can easily be injured to the extent that it will be sensitive for a long period afterward, with a possibly serious effect on the pulp. It may seem superfluous even to mention this minor factor, but when we consider the ease with which the pulp may be damaged, even the seemingly insignificant precautions become important.

3. Dentin may be compressed by inlays which fit too tightly. When we visualize the pulp enclosed in its hard wall of dentin, it can readily be seen how great irritation may result from the compression which takes place when a mesiodistoclusal filling is forced to place. For this reason, all compound inlays should be trimmed so that they can be completely seated by finger pressure. In this connection, the new casting method introduced by Dr. Meyers of Minneapolis, whereby we are able to

overcome shrinkage in making castings is particularly valuable, since these inlays do not fit so tightly as those made by the old method. I mention this point because, in my experience, I have seen a number of bicuspids and molars split through from mesial to distal aspect from forcing a large inlay to place.

4. Dentin protection during restoration is another matter of importance which is too often neglected. Exposed dentin which is unprotected against the invasion of saliva quickly becomes sensitive. This is a sure sign that all is not well within the tooth. Most dentists use temporary filling or guttapercha, while sometimes an exceptionally careful operator will seal the filling in with a solution of rosin and chloroform. I have found that a material which possesses sedative qualities is more effective. In fact, it is essential if the tooth is to receive the best possible protection. There are a number of so-called sedative cements which can be used for this purpose. In making a selection, the following qualities should be sought: 1. It should have both anodyne and antiseptic action. 2. It should be nonconductive. 3. It should set in the presence of moisture. 4. It should be strong enough to retain a temporary filling and make a hermetic seal. It has been my experience that such a material will not only prevent sensitiveness but will relieve it as well.

5. Radical preparation for restoration of tooth structure is another frequent cause of pulp irritation. It is generally accepted that the best way to protect the dental pulp is to stay as far away from it as possible. No more of the dentin should be removed than is absolutely necessary for strength and protection. The teachings of twenty years ago based upon the principles laid down by Dr. Black involved a boxlike preparation which could only be made by removing a large amount of tooth structure. In those days of gold foil and amalgam fillings, this was, no doubt, necessary. With the advent of the new hard golds, the necessity for bulk in order to obtain strength has passed, and a new type of tooth preparation is gradually being evolved. I refer to the slice preparation which has been suggested by K. W. Knapp of Minneapolis, John J. Travis, Henry W. Gillette and no doubt others whose work has not been recorded.

6. Infection of the dentin, which is responsible for loss of the pulp in a large proportion of teeth, is the result of failure on the part of the dentist to sterilize the dentin in deep-seated cavities and to protect the pulp with a cement base. I have found that all careful operators place a thin lining of cement even in shallow cavities as a protection to the exposed dentinal tubuli. This procedure is a protection against the sensitiveness which frequently accompanies the placing of large or small restorations. It is not only indicated when placing metal restorations, but applies particularly in the use of the silicate cements. No silicate filling should ever be placed directly in contact with the dentin. It is my belief that many pulps die as a result of this procedure. We are all familiar with the sensitiveness which frequently results from restoring teeth with gold inlays, and, in this connection, it is interesting to know what Dr. Gillette and Dr. Irving have to say on this subject.

**The question of what kind of a concept the profession ought to adopt as regards the best and most desirable relations between cast gold inlays and interior cavity walls in**

vital teeth and especially in teeth markedly sensitive to thermal shock is not a problem for the expert in casting technique, but for the operative dentist of experience, alert to the factors involved in the relations of metal fillings to pulp vitality and disease, and to the comfort of his patients. While Taggart's experience as an operator gave him a high standing in this field, it would be easy to name a thousand men whose opinions were equally entitled to consideration in deciding what are the safest relations for a metal filling to the pulp of a tooth or to the sensitive areas in its cavity wall.

Here is a question of tremendous significance, because the introduction into a tooth of a metallic mass, in the form of a filling, in very close relation to its more sensitive vital elements, may have disastrous results, and any factors modifying these relations require thoughtful consideration, if dentistry is to serve the public adequately.

With these views I find myself in entire agreement. Gillette and Irving quote the Bureau of Standard Tests on tooth protection against thermal shock. The results of experiments with inlays and thermocouples in varying relations in the tooth specimen show that the rise in temperature was less when "the thermocouple was so mounted as to have a cement layer interposed between it and the inlay which was equal in thickness to the gold inlay and again still more markedly lessened and retarded when the cement layer was doubled in thickness."

It has been my own conclusion from experience and observation in the practice of others that cavities should always be lined. This is true of a shallow cavity as well as a deep-seated one. By following this procedure, it is possible to do away with practically all of the sensitiveness which commonly results from tooth restoration.

In cases in which caries has progressed in the deeper parts of the tooth, the cavity is prepared in the usual way without regard to the carious areas except to remove the walls which are too deeply undermined. After this is done, the carious dentin is carefully removed with a sharp round bur. A therapeutic lining in the form of a paste containing magnesium and arsenic-free zinc oxid, with a small percentage of nitrate of silver, and eugenol is placed over the deep part of the cavity. Care should be observed to keep the paste away from the margins of the cavity in order to avoid discoloration. The method of applying the paste is to carry a small particle to place on the end of an exploring instrument. It is then spread over the desired area with a small pellet of cotton. Only a very thin layer of the paste is necessary. Next, the interior of the cavity is built up to proper form with cement.

In cavities in which there are no carious areas, the silver nitrate paste may be omitted, but the lining of cement should always be applied before the impression for the wax pattern is taken. This is done by placing a small amount of cement on the pulpal wall and, while it is still soft, spreading it over the area with a special instrument designed for this purpose by Dr. Mortonson of Milwaukee. After the cement has set, the wall is carefully smoothed with a carborundum stone of proper shape. The dentinal tubules are now quite thoroughly protected, and the impression may be taken with assurance that the tooth will be comfortable and free from the usual sensitiveness and danger to the pulp.

I believe that frequently restorations are made in teeth whose pulps are not in normal condition and which afterwards die. For this reason, the health of the pulp should invariably be deter-

mined as accurately as possible before the operation begins. Tenderness on tapping the tooth with a metal instrument (traumatic occlusion being eliminated) often indicates disease of the pulp. When a pointed piece of ice is applied to a tooth with a normal pulp, there is a reaction which subsides instantly when the ice is removed. When the ice is applied to a tooth with a pathologic pulp, the reaction lingers for a few seconds after the removal of the ice. If these simple tests were used daily, many affected pulps would be discovered and saved.

Another important thing to be remembered is that pulps may die owing to long continued occlusal trauma. The dentist doing restorative work should always keep a keen eye on the occlusion if he is to render his patient the best possible service. We can learn much from the periodontist on this point.

In making porcelain jacket crowns, the impression should never be taken until the prepared tooth has been carefully coated with a solution of rosin and chloroform as a protection to the exposed tubuli.

Occasionally, it is necessary to make a full gold crown on a posterior tooth. In these cases, the tubuli can be protected with silver nitrate because here the discoloration is not objectionable. The method is to isolate the tooth with cotton rolls and, after drying it, wipe it off with Dr. Howe's ammoniacal silver solution, using a very fine pledget of cotton. This is followed immediately with an application of eugenol.

While the precautionary measures that I have just described are probably familiar to all of you, the vitality of many teeth is endangered, if not actually lost, through our failure to observe these simple measures. The only thing necessary, therefore, is that we keep constantly in mind during all of our operative procedures on teeth that we are dealing with an organ which is unique because its life is so easily jeopardized, and, more important than this, because it is so intimately related to the health of the entire human organism. As professional men, charged with the care of our patients' health, we have no greater nor more urgent obligation than the conservation of the dental pulp.

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DISCUSSION

*Carl J. Grove, St. Paul, Minn.:* I agree with Dr. Davis that sufficient consideration is not being given to the dental pulp in the preparation of teeth in many forms of restoration. The importance of preserving the pulp cannot be too strongly emphasized. We need more papers upon this subject. Just what percentage of restorative work has failed because of neglect to recognize the facts that Dr. Davis has set forth I am not prepared to state, but we all know that too many pulps are destroyed in this manner. While it is true, as Dr. Davis has stated, that the presence of infected pulpless teeth in the mouth is responsible for many serious disturbances, and I am not in favor of retaining such teeth under any circumstances, I believe that infected teeth should always be extracted; but I do not believe that all pulpless teeth should be regarded as being infectious because this assertion has never been proved, and since there is sufficient proof available to show most conclusively that pulpless teeth are not all infected, a tooth should not be extracted merely because it is found to be pulpless. Neither can I agree with the belief of some men that a pulpless tooth will eventually become infected because of lowered resistance due to the absence of the pulp. Investigations have proved that there is no foundation for this assertion. The periapical tissues of many pulpless teeth are no more susceptible to infection than are the tissues of teeth with vital pulps. The most frequent cause for infections following a root canal opera-

tion is the use of permeable materials as a root filling or failure to fill the canal to the dentino-cemental junction, allowing bacteria present in the tubules of the dentin to escape through the foramen and infecting these tissues. If dentists will take more interest in this branch of the dentistry and acquire the skill necessary to fill to the dentino-cemental junction, the percentage of pulpless teeth will be very small, provided impermeable materials are used. I have for some time used gold cones, or what might be better termed gold root canal inlays. The forms of the gold used are standardized or gaged to the apical third of the reamers used in shaping the root canal. In other words, the root inlay is the same diameter as the reamers. Actual measurements of the length of the root as well as the diameter of the apical third of the canal have been compiled from several hundred teeth. The average length and diameter obtained from these findings were transferred to a chart, with the aid of which the operator may know the length of the root to be operated on. I have also included in this chart the size of the reamers indicated for each tooth, thus avoiding the use of reamers much larger than the natural opening of the canal. The first step in this technic is to make a shoulder in the lower part of the pulp chamber by using an end cutting or inverted cone bur. In other words, this shoulder is made at the upper part of the root. The purpose of the shoulder is to furnish a rest for the reamer holder. I have made the holder tapering to the size of the bur, permitting it to pass into the pulp chamber to rest on the shoulder. The body of the handle has a groove extending into the center, and on each side, a vernier scale is made in millimeters, since all measurements of roots are in millimeters. When the reamer or the broach is inserted into the holder, the shank, or the upper part of the reamer can be seen through the groove in the handle. This enables the operator to make a reading of the length of the broach and to lock it in the holder at any desired point, as the case may require, this depending on the length of the tooth to be operated on, a point which is obtained from the reference chart before the operation is started. The broach is now inserted in the canal until the holder rests on the shoulder, when a roentgenogram is taken to determine whether the apex is reached. A fine, smooth broach is always used to avoid injurying the periapical tissue if it should pass through the foramen. If the roentgenogram shows that the desired point has not been reached, the broach is adjusted as the case may require, and is again inserted in the canal, and another roentgenogram taken. If the pulp is to be removed, a barbed broach is inserted into the holder to the same point as that reached by the previous instrument, and a broach inserted in the canal until the holder rests on the shoulder. Since all root canal instruments are the same length, it is known that the apex has been reached, without an additional film being made, and it is also known that the pulp is removed to the dentino-cemental junction. The root inlay is also inserted into the holder in the same manner and to the same point as the instruments. By this technic, it is always possible to fill just to the dentino-cemental junction.

*J. R. Blayney, Chicago, Ill.:* Dr. Davis says something like this (and I am sure he will agree with me when I make this point): That a vital tooth is far more to be desired than a pulpless tooth. He meant a tooth in which a root filling is present. I wish that he had changed that or merely added one word. A little later on in his paper, this same thought came out. I wish that he had said that a tooth containing a vital normal pulp is far more to be desired, and so forth. I make this point because a pulp may be vital, or a pulp is vital, until it becomes necrotic even though degenerative changes are in progress. Teeth containing vital but diseased pulps are frequently far more detrimental to health than many pulpless teeth on account of the ease with which absorption takes place. Before a restorative program can be outlined, the operator must carefully determine the status of the pulp in every tooth that does not contain a root canal filling. Time was when it was considered sufficient if the patient exhibited pain following either thermal or electric irritation. Today, we know that pathologically altered vital pulps respond to such forms of irritation, so the operator must determine whether the pulp is normally sensitive or if it is hypersensitive or hyposensitive, the last two conditions indicating pathologic alterations. The totally necrotic pulp fails to respond to any degree of irritation. To determine the state of the pulp, we depend on such tests as transillumination,

thermal, electric, percussion and the roentgen ray. This last examination will not illustrate inflammatory changes, although it does show conditions which are likely to lead to pulp diseases, such as leaky margins of fillings, proximal surface decay and pockets along the root surface. In some cases, the operator must use all of these tests, together with careful questioning of the patient concerning the history of the tooth, before he can complete the diagnosis. I concur in all that has been said concerning operative trauma as an etiologic factor in pulp degeneration, new burs, stones, rapid cutting, etc. I have found, especially in cases of caries progressing slowly beneath some restoration, that the pulp may be infected and histologically shows chronic inflammatory changes, even though an exposure could not be clinically demonstrated. In these cases, the process already under way will continue, sometimes very slowly, until the entire pulp is necrotic. While the following point was not directly mentioned by Dr. Davis, I cannot take my seat without bringing it to your attention. I have repeatedly heard it said that since, if the cavity is deepened sufficiently to reach normal dentin, exposure of the pulp will result, some drug should be used to sterilize the remaining diseased dentin. This to me is not conservative, but verges on the radical. We can better serve our patients by the removal of all altered dentin and, should the pulp be exposed, by following this procedure with the proper type of treatment rather than ignoring the seriousness of the situation by placing a medicated dressing beneath the permanent restoration.

*Dr. Davis (closing):* The discussion of a paper should always amplify it. An essayist can scarcely ever include in his paper all the points which should be brought out. I was gratified to hear both discussers bring in new elements which added to the value of the entire presentation. I was glad to hear Dr. Blayney remind us that there is a difference between a "vital normal pulp" and a "vital pathologic pulp." It is an important factor to recognize because we frequently experience difficulty in determining whether or not the pulp is perfectly healthy. It may respond to all the tests yet seem hypothermal and oversensitive at times. He is correct when he says that these teeth call for some treatment over a period of time to give the pulp an opportunity to recover. I know from personal experience that this is true. Last fall, I split a lingual wall from a lower bicuspid and practically exposed the pulp, in my own mouth. We attempted to save it by capping. The tooth was comfortable until five or six months later, when it began to get a little more sensitive to cold than it had been. The reaction increased until finally, in six weeks, it was definitely dead and the tooth had to be taken out. No doubt, Dr. Grove could have performed a root canal operation and made it as safe as a pulpless tooth can be made. I prefer to remove all pulpless teeth and thereby eliminate all possible danger to health. Dr. Grove described his root canal technic. I have known Dr. Grove many years, and I have not a doubt that he can treat a pulpless tooth by his method so that it will be a safe part of the dental mechanism. However, I question very much that there are many dentists in this country who can perform this operation with the proper degree of safety. I cannot do it, and for that reason, I prefer to remove all pulpless teeth from the mouths of my patients. I feel then that my work is constructed on a safe foundation and my patients' health is not endangered. There are times, of course, when we must use a pulpless tooth, and men equipped with the experience and skill of Dr. Grove, developed through his years of practice and research, certainly occupy an important place in the ranks of our profession. I think that the day will come when there will be many more root canal specialists, doing work for all of us who have no right to attempt it because of our lack of skill and experience. Far too many teeth are made pulpless through the carelessness of dentists. One evening, a few months ago, a woman called me and asked if I would not come to her home and do something to relieve a toothache. On arriving, I was told that she had a toothache but could not tell which tooth was affected. I found four molar teeth with open cavities apparently prepared for inlays, one with some cement at the bottom. I said, "You are having some inlays made, are you not?" She said, "Yes." I said, "How long since you have seen your dentist?" "It is now several weeks, three or four, since those teeth were ground out," she replied. Of course, all four teeth were ach-

ing because the dentin had been exposed to saliva for such a long period of time. I later learned that two of the teeth had to be devitalized because of the fact that the pulps could not recover from the condition which had developed. I am convinced that many pulps ultimately die, without our knowledge, from just such treatment. If the individual dentist expects to succeed in practice and do his bit to establish dentistry in its proper place among the scientific professions, he must cease to hurry and must invariably leave no stone unturned to protect the dental pulp.

# A REVIEW OF FULL DENTURE THEORIES*

By A. E. BOYCE, D. D. S., Tuscola, Ill.

I WAS asked to give a review of full dentures theories probably because I have been actively interested in the diversified schools, theories, and technics of denture contruction together with their instruments; and because I have the questionable fortune of being a prosthetic denture-wearer myself. If my story to follow is typical, the fact of personally wearing prosthetic dentures should be made a *sine qua non* of the qualifications, especially for those in our ranks who make denture theories their hobby.

I confess that my enthusiasm in denture theories used to register higher than my ability to apply them. Today, after extended study and experience, I am convinced that many of my efforts led to discouraging results because of misleading theories upon which I pinned my faith. Almost every prosthetic theory I indulged in was complemented by a more or less expensive instrument, commonly called a dental articulator, and I have on a shelf in my laboratory something like $350 worth of discarded articulators.

In the following paragraphs, I shall report some very personal prosthetic experiences, in spite of the fact that it is sometimes an unpleasant task to report one's own doing truthfully. I only do so because I believe that an authentic report will stimulate progress.

Although I have been in practice for thirty-four years, my ideas regarding denture prosthesis during the first twenty-two years were about the same as those of nearly 75 per cent of present-day practioners; that is, after making an impression and taking a "bite," I sent the work to a commercial dental laboratory.

The results of such routine procedure were uniformly unsatisfactory in the light of possible attainments of today. In my unbiased judgment of yesterday (which lacked up-to-dateness), 20 per cent of my cases were failures because they gave neither comfort nor masticatory service. At least 40 per cent were merely tolerated. This left less than 40 per cent which were successes, judged so, because they looked right to me and were rated by the patient as comfortable or efficient, or both—or were never heard of.

*Read before the Section on Full Denture Prosthesis at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 23, 1928.

My interest in and my desire to do better denture work was kindled by the publications of Drs. Williams, Clapp and Gysi. Their writings induced me to purchase a Gysi "simplex" articulator. The Gysi adaptable seemed entirely too complex. Results: 20 per cent failures, 40 per cent tolerations.

At the Indiana State meeting in 1916, Dr. Hall gave a lecture and clinic on the conical theory of articulation, and I absorbed a few ideas on impression taking.

In September, 1917, Dr. House gave an all-day lecture clinic before our local Society, the Eastern Illinois Dental Society, and succeeded in fanning my sparkling *desire* to do better "plate work" into a determined *will* to do so, to which was soon joined enthusiasm to acquire prosthetic knowledge. In the light of present-day knowledge, I consider denture prosthesis as I executed it at that time just "plate work." So when in May, 1918, Dr. House organized a class at Decatur, Ill., I enrolled, participated in one week of intensive study, purchased a Hall "automatic anatomic articulator" and doubled my fee for denture service. Denture results: 20 per cent failures, 40 per cent tolerations. Such "results" did not please me at all.

By August of that year, I realized that I had not fully mastered denture prosthesis, so I enrolled in another class under Dr. House at Indianapolis. Another week of intensive study, and I was back at my work. Denture results: 20 per cent failures, 40 per cent tolerations.

After a little more than a year of reading everything published on denture prosthesis available to me and spending all my spare time in experimentation on hypothetical as well as practical cases, I heard of Dr. Monson's spherical theory, so, in November, 1919, I enrolled for a class at Chicago, under Dr. Monson, with another week of intensive study and practical work.

At the close of this class, Dr. House was also putting on another class at Indianapolis, and as my prosthetic fever ran very high, I journeyed thither the next week and took another course.

Equipped with the conical and spherical theories and instruments, and reinforced by experiences, I returned to work. Denture results: 20 per cent failures, 40 per cent tolerations.

In March, 1920, Dr. Monson gave another class in Chicago, which I also attended.

I merely give you the foregoing chronology that you may visualize the workings of the "Spyrococcus articularis," also called the articulator bug.

In April, 1920, I suffered a severe case of neuritis. At the time, it was decided to "surgically remove" my teeth. The operation was a success as far as the elimination of the neuritis was concerned; however, the technic was so radically applied that I cannot but pronounce the operation as having been overdone. The gum tissues left are tender and sensitive to this day.

I made dentures for myself, first on one instrument and then on the other. Some dentures I made all alone, others with the assistance of a fellow dentist who had also "run" the courses. Denture results: toleration, and hardly that.

So I journeyed to St. Paul and spent a week with Dr. Monson. Denture result: mere toleration—no comfort, no efficiency.

I look back to the teachings of Monson, Hall and House with no ungrateful feeling whatsoever. Quite the contrary. I gathered from them useful hints and laboratory procedures some of which I still apply today. The articulator theories and technics they advocated I have since greatly modified or abandoned, as have Hall and House.

In the light of today, I realize that the dentures that I made were actually better from the standpoint of construction and appearance than those made fifteen years ago. Their function could not have been better except when a patient happened to fit the articulator used. I also realized that there is such a thing as not being satisfied with dentures in spite of the gentle reproof that "the patient has to get used to them."

These, with several other sets of my own construction, I tolerated until the National meeting at Milwaukee in 1921, where I first heard of the Hanau theory and instrument.

Dental meetings always are an inspiration and a fountain of information. So it was with the Milwaukee meeting, though I did not realize it fully until some time later. At this meeting, I found a new theory and its accompanying new instrument. The instrument attracted me because it was different from all the others that I knew. The importance of theory was not overly emphasized by the author, Rudolph L. Hanau, an engineer and not a dentist, who viewed our prosthetic problem in a very unconventional way. Hanau laid much stress on the necessity of making accurate maxillomandibular measurements for the purpose of adjusting the articulator guidances. His explanations and claims sounded very logical and reasonable to me.

So I again plunged into a new articulator venture, one I have never regretted to this day.

I spent an evening with Hanau at the hotel. He explained his articulator technic and demonstrated it on his Model "F" in minute detail, and I rehearsed the procedure.

After receiving the Hanau articulator through the mail, I mounted one of my traumatizing sets of dentures with the face-bow in the articulator, made jaw registrations and adjusted the articulator guidances, following the typewritten instructions minutely. Then I corrected, by careful grinding, the cusp interference found in articulator function.

The unexpected happened. The set of dentures felt very comfortable. I was delighted because, for the first time, I enjoyed rest and comfort. My appreciation rose when I discovered that I could masticate as I expected to.

After this experience, I built a new set of dentures, in compliance with my newly acquired technic and experience, on the improved Hanau articulator model "H." The new dentures were still more comfortable and more efficient in mastication. My enthusiasm and interest in denture work grew and rose higher when I attained convincingly good results with many of my patients.

That my case must be typical of thousands of others is proved to me by the large percentage of my patients who came in after they had worn from three to eight sets of dentures which afforded neither comfort nor efficiency.

Since 1922, I have used the Hanau instruments. They give good results, if applied in strict conformity with instructions prescribed by the Hanau intra-oral technic.

It may be of particular interest to mention that the condylar indications of my case were minus 12 on the left and plus 29 on the right, and that I associated centric occlusion of the masticatory surfaces with right lateral jaw relation.

Later on, Hanau suggested that I also build a set of dentures which, when inserted, should associate centric jaw relation with centric occlusion. That was done. The combination functioned correctly, but did not give the same comfort, and the set was therefore discarded.

It may be of further interest to record Hanau's prediction that the condylar indications will gradually approach each other, and that the mandible will gradually return toward centric relation as the most comfortable jaw relation to be associated with centric occlusion. That actually has happened. My latest set of dentures associates centric occlusion with a very much diminished lateral relation and the condylar indications vary only from 8 to 10 degrees. They are now plus 12 degrees on the left and plus 22 degrees on the right.

Those of you who attended the Section on Denture Prosthesis at Detroit, in 1927, at which Dr. Sears read a paper on channel type posterior teeth will recall the report of satisfaction with my then newly constructed dentures built with channel type posterior teeth. During the intervening time, I have built dentures for my patients, as well as another set now in my own mouth, using this type of tooth, and I can report continued satisfaction in their use, both from the standpoint of increased efficiency and from the standpoint of reducing trauma to the tissues. In short, I might summarize my denture experience by saying that the knowledge received from Hanau and the teeth received from Sears have made practice more pleasant and my mouth more comfortable.

Dentists, during the last ten years, could have been spared many trying experiences and disappointments had they been thoroughly trained in the fundamentals involved. The dentist of tomorrow will be in a more fortunate position with a better foundation. Our schools and colleges have improved their methods considerably, and a laudable spirit now exists in the profession which spells cooperation. The oncoming generation should take advantage of all that it can gather in knowledge and experience. It means both pleasure and profit in our professional life.

DISCUSSION

*Kent Kane Cross, Denver, Colo.:* When the patient has his or her mouth full of trays and impression material, it is the dentist's time to talk; when a prosthetist places himself in the chair, opens his own mouth, and makes an impression of his denture area, it is his time to think. Putting one's self in the place of the patient is always conducive to better dentistry. I have followed, in class and study work, the instructors mentioned by Dr. Boyce, with others of equal skill and ability, and any knowledge of prosthesis, or inspiration toward attainment, I owe that association. No one man has ever yet gleaned or discovered the whole truth concerning a scientific subject. Pioneers in modern prosthesis, these men have blazed the way for an untrained profession and an awaiting public. The precious hours devoted to the efficiency and appearance of the edentulous are gone forever, their findings, like those of their predecessors, Bonwill, Walker, Christensen, Snow and Gysi, are the stones upon which their successors build. Deductions based upon rational theories, plus a large number of tests, usually establish themselves as sound, in the healing and restorative arts. Success or failure in Dr. Boyce's own case has been based

on one very important part of denture service, masticating efficiency, without cuspal interference, or displacement. Perhaps with normal or average condylar movements, he would have been just as happy with the dentures built on the spherical or conical instruments. Perhaps, also, careful technic with another instrument adjustable to individual variances would have been equally successful. The fact that his condylar excursions have been reduced to practically normal curves would suggest that, in cases as nearly average as his now is, the careful use of an instrument giving an average movement would cause slight condylar adjustments according to the new curve, and give comfort and the efficiency of balancing contact. The proof of the pudding is in the eating, but just think of the hapless, but happy thousands wearing little plates built on the barn door hinge. I have recently used the Sears channel posterior teeth and can see no theoretical or practical objection to them. They look well, function well and may take their place in the better and more practical prosthesis that is in store for those who are willing to accept the best and pay the price.

*Elbert C. Pendleton, Chicago, Ill.:* I quote from Dr. Boyce's paper: "I confess that my enthusiasm in denture theories used to register higher than my ability to apply them. Today, after extended study and experience, I am convinced that many of my efforts led to discouraging results because of misleading theories upon which I pinned my faith. Almost every prosthetic theory I indulged in was complemented by a more or less expensive instrument, a so-called dental articulator." I have watched with no little interest the progress in full denture prosthesis and have been impressed by the facts as stated by Dr. Boyce in the foregoing paragraph. My observations lead me to believe that too many men pin their faith to theories and depend on articulators to solve their problems instead of making a careful diagnosis and formulating a definite plan of operation whereby each step in the technic becomes an integral part in the scheme for rendering a successful service. The limitations of the articulator have been summarized admirably by Charles R. Turner in the recent edition of the "American Text Book of Prosthetic Dentistry," from which I quote: "The anatomical articulator must not be viewed as an instrument of mechanical precision in the sense that it can accurately reproduce mandibular movements and the contact relations of the teeth in function. No mechanical device is capable of imitating in its construction the compressibility of the soft tissues intervening between the bones at the temporomandibular joint, nor the effect of the elasticity of the ligaments which restrict the jaw movements. Neither can it represent the varying pull of the muscles or the balance which their varying contraction may establish in jaw relations. Furthermore, it must be remembered that, in the mouth, dentures rest upon resilient bases which yield under the pressure of mastication; while, in the articulator, these dentures in process of construction rest upon unyielding casts of plaster or artificial stone." One has to examine but a few of the hundreds of dentures at our clinics to appreciate the fact that failures can most often be attributed to a lack of understanding or a failure to apply the basic principles in impression taking, tooth selection and arrangement, denture design or any one of the many steps in the technic of denture construction. Full denture technic is not one that can be divided and every effort concentrated on one certain phase of the work. Each step is of such importance that, in order to render a satisfactory service, the technic must be so complete that each step is a complement to every other, and then and only then may we hope for success. If I understand Dr. Boyce correctly in his reference to the "surgical removal of his teeth," surgery in his case was not altogether successful, probably owing to the heroic measures employed. Surgical preparation of the jaws with reference to full dentures should be limited to the conservative removal of abnormally developed structures that would interfere with the esthetic and mechanical requirements in the construction of full dentures. Such a surgical plan is eminently successful and is to be recommended if the most satisfactory results are to be obtained. I have never used the "channel teeth," referred to by Dr. Boyce, and I would like to ask if their indication is comparable to the Gysi cross-bite teeth. We have under observation 148 cases in which cross-bite teeth were used. The patients for whom these cases were constructed have expressed a satisfaction

which is beyond our expectation. Forty-six of these cases were constructed during the last half of the year 1927; 102 have been constructed in the present year. I agree with Dr. Boyce that the works of Williams, Clapp and Gysi are the impelling force which has inspired men to greater efforts in denture prosthesis. The theories which these men have studied are the laws which govern our practice. Perhaps the greatest single factor in the successful management of full denture cases is the judgment displayed in diagnosis and prognosis. Successful full dentures always display to a marked degree evidence of these essential attributes.

# DIAGNOSIS AND TREATMENT OF CHRONIC OSTEOMYELITIS OF THE MANDIBLE AND MAXILLA*

By STERLING V. MEAD, D.D.S., Washington, D. C.

THERE has been a vague discontent and dissatisfaction in the minds of many of us regarding certain systemic disturbances which are apparently caused by some bone disease with ill-defined symptoms and which our methods of diagnosis often fail to disclose. Your attention is, therefore, directed to a phase of a disease which will no doubt occupy more and more of our attention as we study it. A search of dental and medical literature will reveal a wealth of material on the subject of acute osteomyelitis of the jaws; but while a few individuals seem to be familiar with a chronic phase of the disease, it is undoubtedly not commonly recognized. Furthermore, there is a phase of chronic osteomyelitis which has apparently been overlooked.

This paper is the result of the study of a series of cases aggregating more than 100, wherein the peculiar type of bone disease has occurred spontaneously, and has not been the result of a preexisting acute condition. It, therefore, differs materially in etiology, symptoms and treatment from the ordinary chronic osteomyelitis resulting from acute conditions.

Osteomyelitis is an inflammation of the bone marrow, or of the periosteum, the cortex and the marrow. It may be either acute or chronic. The acute form is characterized by fever, chills and general debility and is attended by suppuration with rapid destructive progression. The chronic form results in rarefaction and condensation of bone, and pain or other alarming local symptoms are usually absent.

Inflammatory reactions of the maxillary bones may be classified according to the anatomic situation of the lesion into three divisions: (1) periostitis, inflammation of the surrounding membrane of the bone or periosteum; (2) osteitis, inflammation of the bone structure proper, and (3) osteomyelitis, inflammation of the medullary cavity.

It is important to realize that, in practice, no such definite anatomic limits to the inflammation exist. When the periosteum is inflamed, the underlying bone is always affected to a greater or less extent, while diseases involving the medullary cavity invariably affect the bone surrounding it. In a similar way, if the

*Read at the Sixth Annual Meeting of the International Association for Dental Research, Washington, D. C., March 26, 1928.

bone itself is first affected, either the periosteum or medullary cavity or both are soon involved.

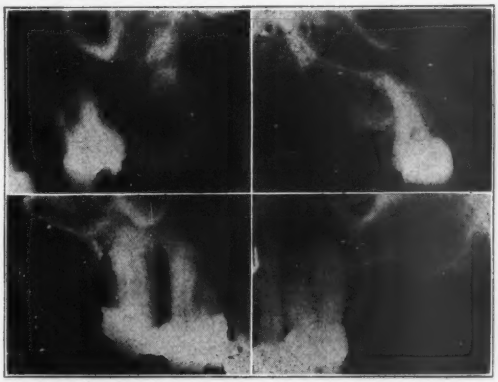

Fig. 1.—Above: Left: Chronic osteomyelitis of the tuberosity region of the maxilla. The new bone had a chalk-like consistency. Right: Chronic osteomyelitis in third molar region of maxilla. Two molar roots are shown and no definite bone disease is disclosed. The bone around the roots was found to be definitely honeycombed and diseased. Below: Left: Upper third molar region, showing osteoporosis and osteosclerosis as a result of chronic osteomyelitis. The bone was found to be definitely honeycombed. Right: Upper second molar region showing rarefying osteitis as a result of chronic osteomyelitis.

The development and structure of the long and flat bones of the body are similar. Each bone consists of a dense outer cortex surrounded by a highly vascular membrane, the periosteum, and having on the inside a more spongy, diploic layer, more richly supplied with vessels than the outer denser layer. The flat bones do not have the actual channel, filled with marrow, as do the long bones.

ETIOLOGY

Chronic osteomyelitis is caused by the presence of portions of broken-off roots, impacted and unerupted teeth or foreign bodies, sources of infection which have remained in the bone after the removal of the cause; or by any form of irritation or low-grade infection.

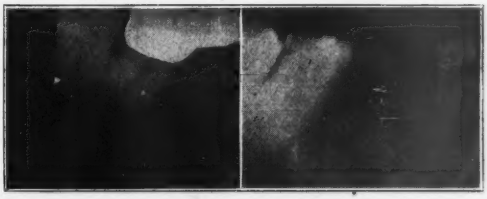

Fig. 2.—Left: Sclerotic bone under bridge having the appearance of a root. Right: Appearance after removal of this condition.

It has been my experience, in the case of roots which have remained any appreciable length of time in the bone after

extraction, to find a definite chronic osteomyelitis. In most cases, the roentgenogram does not show a definite rarefied area, but on examination during the

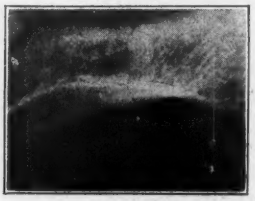

Fig. 3.—Root in the molar region of the mandible with no definite appearance of disease in the bone. When this area was opened, a chronic osteomyelitis was found to exist.

surgical removal of the roots, there is found a honeycombed condition, the affected area being spongy and easily removed with a curet or other instrument.

Fig. 4.—Impression of the mouth, showing bulging in the bicuspid and molar regions. (Figures 5, 6 and 7 are from the same case.)

Chronic osteomyelitis may be found in both the maxilla and mandible. In the maxilla, the infection may gain entrance through the nasal mucosa and maxillary sinus. Likewise, a chronic

Fig. 5.—Intra-oral view showing honeycombed condition with areas of rarefying osteitis and osteosclerosis.

osteomyelitis of the maxilla may readily involve the maxillary sinus. A chronic osteomyelitis of the walls of the maxillary sinus is not uncommon. It is very difficult to diagnose. It may be due to an extension of periapical, pericemental or pericoronal disease, which may occur either directly or from a thrombophlebitis. In many cases, even though edentulous, there may be residual infection in the maxilla where infected teeth have been removed and the diseased area has not been completely removed. This may become occluded by cellular proliferation and the infection become locked in; and the same environment is thus established for anaerobes as existed previously. The most common sites of chronic osteomye-

Fig. 6.—Small intra-oral view showing molar region.

Fig. 7.—Section made through the decalcified tooth and its accompanying attached alveolar processes showing considerable thickening of the cancellated trabeculae with narrowing of the haversian canals and the bony lacunae, accompanied by a marked fibrosis of the tissue of the cancellated marrow spaces. The pericemental membrane is markedly thickened and sclerotic. In certain areas throughout the marrow spaces of the bone, there is evidence of a low-grade chronic inflammation characterized by patchy round-cell infiltration and endothelial proliferation of the preformed blood vessels.

Fig. 8.—Impression showing hyperplasia on the palatal surface of the upper right molar region. (Figures 9-15 are from the same case.)

Fig. 9.—Extra-oral roentgenogram showing sclerotic hyperplastic bone with worm-eaten appearance in the upper molar region which overshadows the coronoid process.

litis are the molar regions of the mandible and maxilla.

SYMPTOMS

Chronic osteomyelitis is characterized by a long continued inflammatory process with alternating areas of bone destruction and bone formation. In some cases, the disease is confined to rarefaction of bone. The process is insidious, and the symptoms are usually so slight or so ill-defined that the patient is not

Fig. 10.—Extra-oral roentgenogram taken from another angle, showing the sclerotic hyperplastic appearance of chronic osteomyelitis.

aware of the disease. Attention is usually drawn to this type of bone disease by a bulging or swelling on the buccal or lingual plate or by subjective symptoms. The patient may complain of indefinite pains radiating in the ear or a dull uneasy sensation in the particular region involved. In some cases, the throat or maxillary sinus may give symptoms of inflammation or even suppuration or excessive mucus discharge without any apparent cause.

In the type of chronic osteomyelitis following acute osteomyelitis, bone destruction is the important pathologic process, a necrosis that goes on, often over a period of years, to the production

In chronic osteomyelitis, the roentgenogram may disclose alternating areas of bone destruction and bone formation. The areas of new bone formation are denser than normal bone.

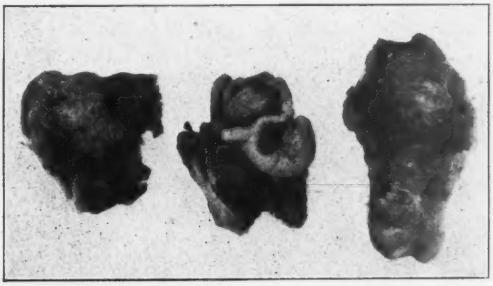

Fig. 11.—Appearance of teeth removed from the molar region, showing the diseased bone attached to the root and partially covering the crown.

of sequestra of various sizes. This necrosis is associated with and is the essential cause of, continued suppuration. In the type of chronic osteomyelitis under discussion, sequestration does not occur.

In chronic inflammation of the bone marrow, disintegration or caries of the

As infection spreads, the calcium salts are relatively slowly absorbed, and as the infection extends, islands of bone are left between the areas of infection. The bone changes in the maxilla and the maxillary sinus are not usually roentgenographically diagnostic.

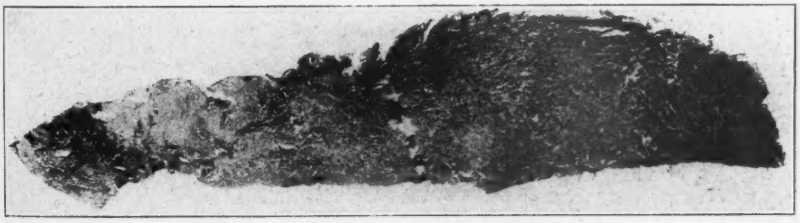

Fig. 12.—Microscopic appearance of pathologic tissue.

bone results. During this chronic course, new bone formation often takes place, some of the new bone being denser than normal, and areas of bone resorption and new bone formation may alternate, giving the bone a ragged or "moth-eaten" appearance.

In many cases, the clinical examination, including the roentgenographic examination, fails to disclose any apparent abnormality, and the disease is discovered by symptoms expressed by the patient; or the roentgenogram may disclose suspicious areas, which require an ex-

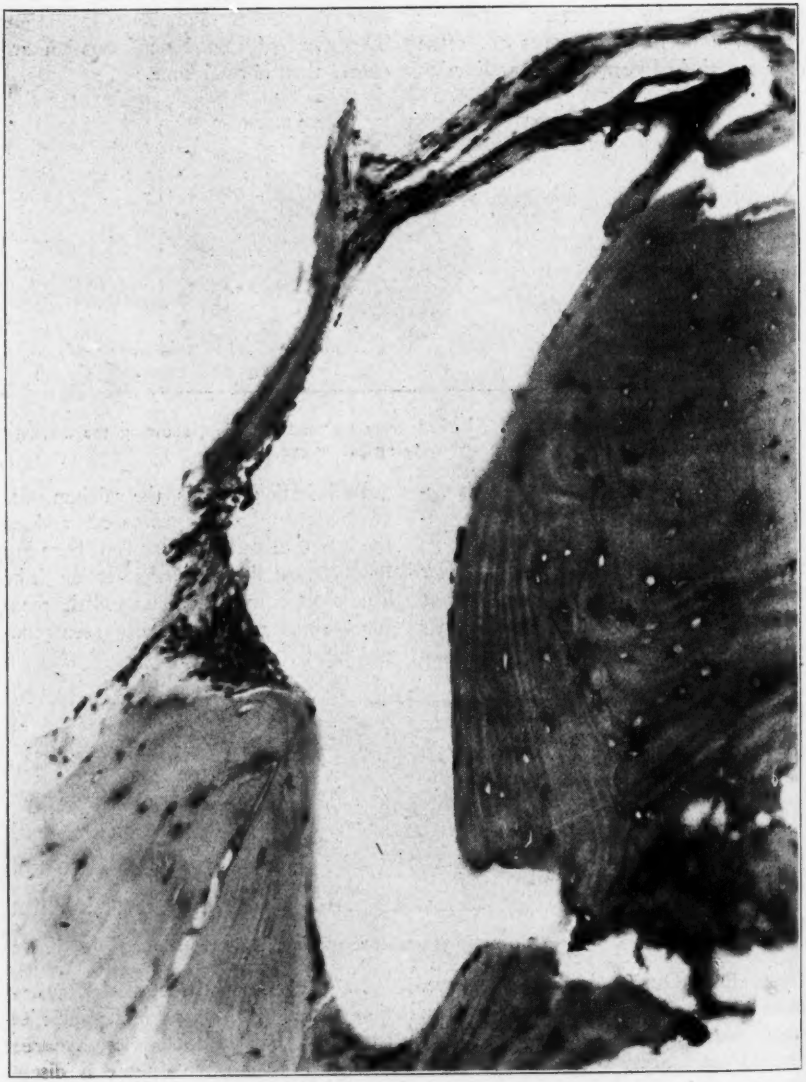

Fig. 13.—Pathologic bone.

Fig. 14.—Character of the diseased bone, showing a fibrosis of the tissue of the cancellated marrow spaces, endothelial proliferation, obliteration of preformed blood vessels, narrowing of the haversian canals and bony lacunae.

**Fig. 15.—Patchy round cell infiltration characteristic of inflammation.**

Fig. 16.—Root in lower third molar region surrounded by a sclerotic area. When this area was opened, a widespread area of moth-eaten appearance was found, characteristic of this chronic osteomyelitis.

ploratory operation to determine whether or not there is an actual pathologic process present. In many cases, the roentgenogram will show what is apparently normal bone, of a very cancellous nature or not so dense as the average normal case; or it may disclose roots or small areas of osteosclerosis. When these areas are opened, the condition is often found to be much worse than was indicated as the tissue may be very soft and spongy and easily scraped with a curet. The area, which has a honeycombed appearance, consists of a bony framework without any bone consistency or body. On removal of this tissue, a watery, yellowish brown serum exudes. I have found this condition invariably around pieces of root left in the bone.

PROGNOSIS

The immediate danger from this particular type of chronic osteomyelitis is not great. There is a low-grade infection which gradually undermines the general system and resistance. However, this type of bone disease gradually lowers the resistance of local tissues and is often the cause of a flare-up of acute osteomyelitis.

TREATMENT

In the extraction of teeth, every piece of root should be removed, even though it is necessary to sacrifice an adjoining healthy tooth, which would rarely occur. There are a few cases, especially in the upper third molar region, in which the removal of an apex of a third molar is almost impossible without removal of the second molar.

Treatment of chronic osteomyelitis depends on the type of disease with which we are dealing. A chronic condition following an acute condition is best treated by allowing a complete sequestration of diseased bone. The area should be drained well and the sequestra removed as formed, but there should be no curetting or scraping of bone. In the type of chronic osteomyelitis which occurs without any previous condition of acute osteomyelitis, there are no acute symp-

Fig. 17.—Left: Particle of root in the upper molar region. The worm-eaten appearance of the bone is evident. Right: Particle of root in the molar region and particle of root in the bicuspid region. (Figures 18-22 are from the same case.)

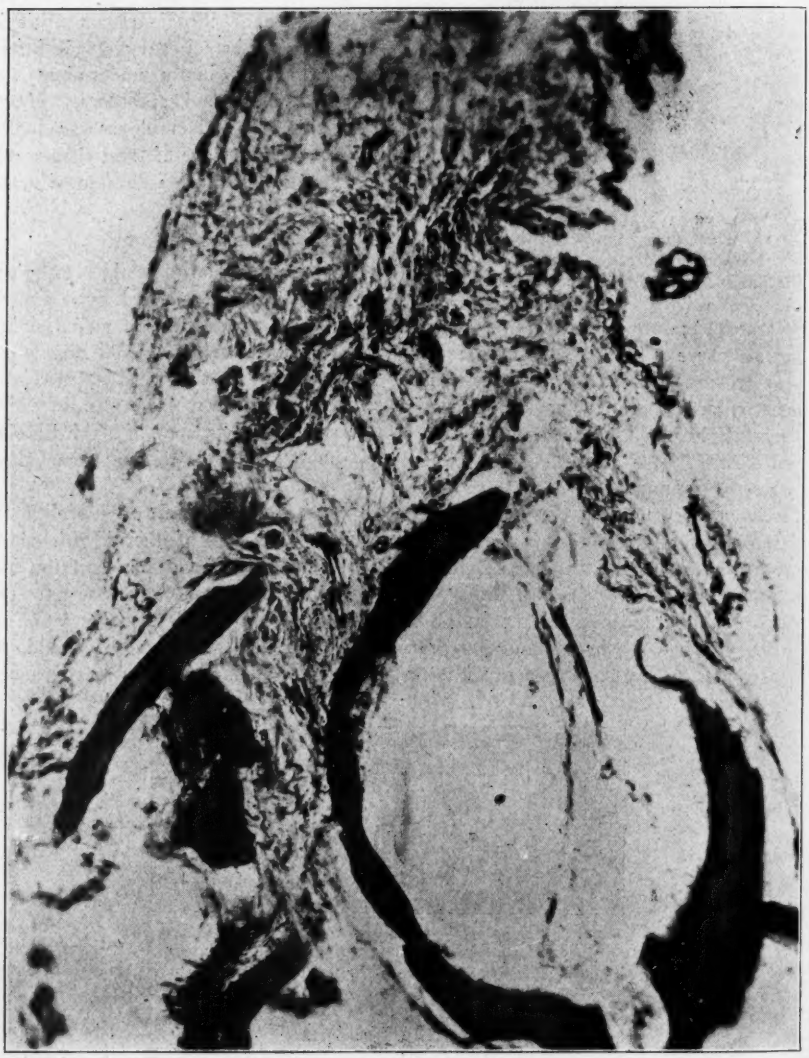

Fig. 18.—Pathologic process of bone.

Fig. 19.—Appearance of the bone.

**Fig. 20.—From another area (compare Figures 19 and 20), showing bone disease.**

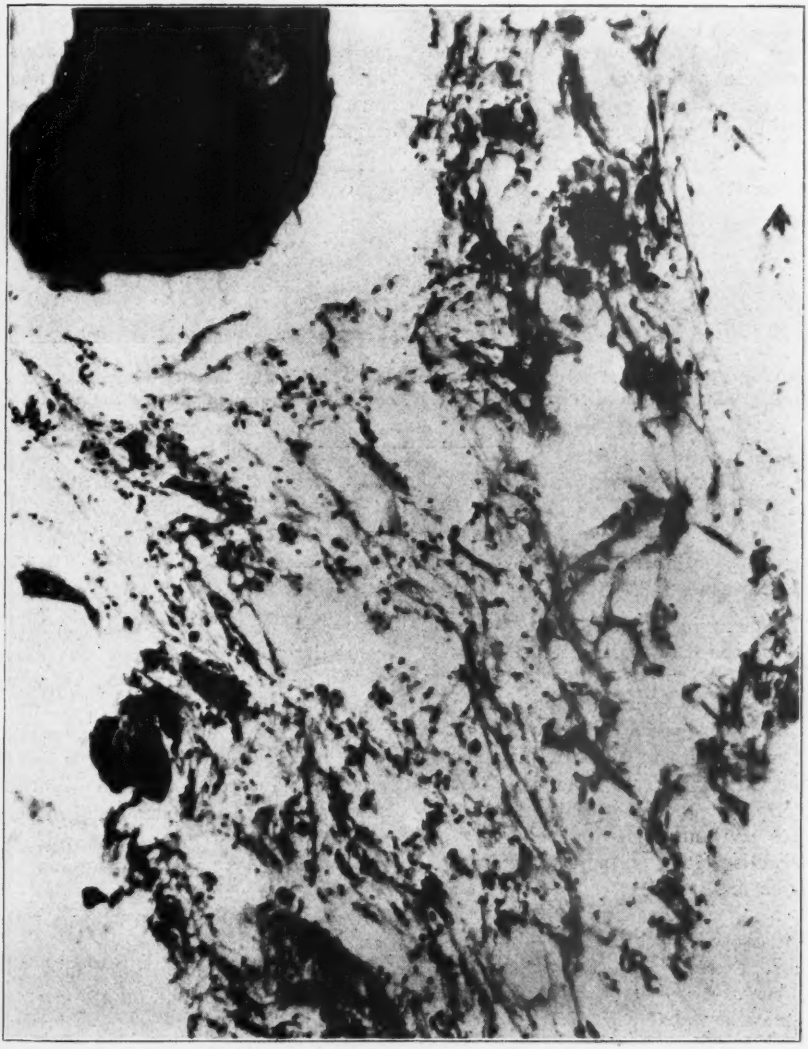

Fig. 21.—Section from another area. (Compare Figures 19, 20 and 21.) Sections made through the decalcified roots and accompanying attached alveolar processes show considerable thickening of the cancellated trabeculae with narrowing of the haversian canals and the bony lacunae, accompanied by a very marked fibrosis of the tissue of the cancellated marrow spaces. The pericemental membrane is markedly thickened and sclerotic. Apparently, there is atrophy of the cementum, condensation of which has obliterated the cemental cells. In certain areas throughout the marrow spaces of the bone, there is evidence of a low-grade chronic inflammation characterized by patchy round-cell infiltration and endothelial proliferation of the preformed blood vessels. No evidence of any malignant change can be demonstrated. The microscopic picture presented is that of a chronic plastic, sclerotic process resulting from long standing chronic irritation. The diagnosis is chronic osteomyelitis.

toms and no definite exfoliation of sequestra. There may be just osteoporosis resembling a plain osteitis, or there may be alternating areas of osteoporosis and new bone formation. These areas require surgical removal and curetting down to normal tissue, and if any roots are present, they should be removed.

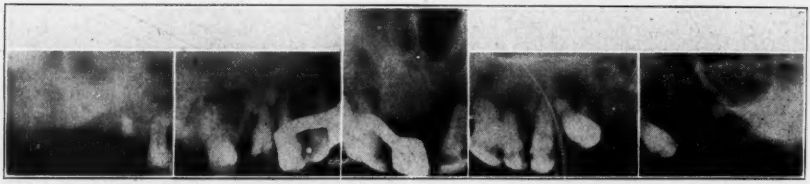

Fig. 22.—Intra-oral roentgenograms of the upper teeth and maxilla, showing chronic plastic, sclerotic process resulting from long continued irritation of chronic osteomyelitis.

# GOLD FOIL*

By CARL R. OMAN, D.D.S., Minneapolis, Minn.

IN discussing the subjects of gold foil as applied to operations in the human teeth, it is well to bear in mind the object sought for in such procedure, the ideal toward which we are working. If it is our purpose to check permanently the ravages of decay and to restore to normal contact and continuity of surface the human tooth on which we are operating, gold foil must be the material of choice.

No great advance has been made in the use of gold foil in dentistry since 1895, except by that comparatively small group of men who have been organized in study clubs; and the time of these men has been largely devoted to the perfecting of their own skill and ability in the old tried and proven methods. It is to these study clubs that dentistry owes the survival of this, the best method of tooth conservation; for who will deny that the present trend in dentistry is toward that which is easiest, rather than toward that which is best? We are influenced too greatly in this commercial age by the amount of money we can obtain for our services, and in our haste to become the possessors of more wealth, we lay aside our ideal—and dentistry suffers, our patients suffer. Most of all, we suffer.

Gold foil is the only filling material with which water-tight fillings can be made. How often are we not thrilled to see a case in which gold foil operations have been *in situ* for periods of from ten to fifty years and are apparently in as good condition as ever? the tooth free from recurrent caries; no absorption of soft tissues; no pyorrhea pockets; no alteration of material—a glowing tribute to the skill and devo-

*Read before the Section on Operative Dentistry, Materia Medica and Therapautics at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 22, 1928.

tion to duty of the operator who placed them.

There is no other material which will so well enable us to take advantage of the elasticity of the dentin in securing close adaptation to the cavity walls or that can be handled with greater ease to one practiced in its use. The walls of the dentin are actually pushed aside in condensing the gold. The tendency of the dentin is to spring back and, in so doing, it exerts a tremendous retaining force on the mass of the gold. The gold itself, once it is welded, is of course permanent and indestructible, and when it has been driven in with sufficient force and at the proper angle, a permanent filling results. It is this property of gripping by the dentin, together with the permanence and indestructibility of gold, that makes gold foil the filling material without an equal.

G. V. Black, author of that monumental work on the subject of operative dentistry, has laid down for us in a clear and concise manner those principles which should govern all our operating. Allow me to enumerate the qualities most desirable in a filling material for permanent operations: (1) indestructibility in the fluids of the mouth; (2) adaptability to the walls of the cavity; (3) freedom from shrinkage or expansion after being made into fillings; (4) resistance to attrition, and sustaining power against the forces of mastication. Of these qualities, gold foil seems to possess those most essential to a greater degree than any other filling material.

Gold is prepared in the form of foil for our use in the filling of teeth. This foil is of various thicknesses and is classified as to number by the number of grains of gold in a sheet 4 inches square. If a sheet of gold foil of this size contains 2 grains, it is known as No. 2. If it contains 4 grains, it is known as No. 4, etc., up to the heavier foils. The foil which seems to enjoy the greatest popularity at present among gold foil enthusiasts and study club members is the No. 4 foil, which is easily rolled into cylinders or pellets of the desired size. The manufacturers also place at our disposal pellets of varying sizes in the form of rolled gold cylinders, and it is a matter of choice whether a man cares to use a hand-rolled or machine-made pellet.

Gold foil in the form of cylinders or pellets possesses the property of welding perfectly in the cold state when clean surfaces are pressed into contact and is the only metal which possesses this quality to any great degree. To make use of this property, it is absolutely necessary that the surfaces which are brought in contact be clean and free from contamination of any sort. If they are not clean, the property of welding can be lost and the foil will be rendered useless for our purpose. Let us therefore acquaint ourselves with the conditions which develop this property or those which help destroy it.

Gold does not oxidize as does silver or platinum. Oxygen and nitrogen are not attracted to its surface as they are to the surface of other metals. It is this property which allows it to be welded cold. Gold does attract to its surface certain gases which are always present in our atmosphere, and these gases often condense in such quantities as to destroy the welding properties of the metal. These gases do not unite with the metal to form any new compound or to affect its purity, They usually can be driven off by annealing and the welding property is thereby restored. Sulphur and

phosphorus gases sometimes are present in the atmosphere of our offices. They condense on the surface of the gold and form a fixed salt which is nonevaporable by heat; consequently, the welding property of such gold is permanently lost.

It is the acid gases that form this salt and destroy the welding property of the gold. Experimentation has proved that gold kept in an atmosphere containing a liberal amount of ammonia does not lose its cohesiveness. I would suggest in this connection a closed drawer containing a small amount of spirits of ammonia on a sponge or cotton roll and placed in a small bottle to avoid staining. Ammonium salts will then be formed on the surface of the gold. The salts are readily evaporable by heat; hence, the welding property is restored, and the surfaces being clean, the gold is always ready for use.

The successful use of gold foil as a filling material presupposes the mastery of a most exacting technic. The rubber dam must always be used, and a sufficient number of teeth on either side of the one to be operated on should be included in the application. This makes for a clear field, free from saliva or moisture of any sort, clear vision and greater ease of access, and the operator can proceed with the work at hand with the assurance that his work will not be ruined before completion by influences beyond his control.

It would be well to add here that skill in applying a rubber dam is much to be desired, and those who do not possess such skill should make an earnest effort to acquire it. Prepare the teeth over which you wish to apply the dam by careful removal of all calculus or food débris with instruments. Then spray the area with a warm antiseptic solution to carry away all loosened particles. Paint the area after drying with a weak solution of tincture of iodin or mercurochrome. Select a piece of sterile rubber dam at least 6 inches square, and punch holes in it as indicated, about three-fifths of an inch apart for the lower incisors, slightly less for the uppers. Soap the holes so punched and gently slide over the teeth to be isolated. Place the clamp on the last tooth included posteriorly, the lingual jaw of the clamp being placed first, and gently slide the buccal jaw up along the buccal surface until it comes to rest just above the greatest convexity of the tooth. If carefully placed, a clamp should not cause pain. Now take a small piece of modeling compound, heat in the flame, roll into a ball and place over the occlusal surface of the tooth and under the jaw of the clamp. Cool with a few blasts of air, and the clamp is held in place and entirely comfortable. Next, dry the surfaces of the remaining teeth. Gently turn back the edge of the rubber on the tooth and tuck it in, and the saliva is effectively excluded.

There is rarely any necessity for tying a ligature about a human tooth, and allow me to caution against the practice. It is cruel and productive of much harm when forced up under the free margin of the gum, there to destroy the attachment, to produce stasis, and having driven the blood, Nature's natural defense, out of this area, to invite disease and probable loss of the tooth. With a little practice, one can become expert in the application of the dam and its retention with the use of modeling compound.

The principles of cavity preparation have been laid down for us by Dr. Black, to whom we owe so much, and

we will do well to follow his precepts and example.

The classes of cavities are as follows:

Class 1: Cavities beginning in pits and fissures.

Class 2: Proximal cavities in bicuspids and molars.

Class 3: Proximal cavities in incisors and cuspids which do not require the restoration of the angle.

Class 4: Proximal cavities in incisors and cuspids which do require the restoration of the angle.

Class 5: Buccal and labial gingival third cavities.

It will readily be appreciated from this outline that the majority of gold foil operations for the average dentist will come in Classes 1, 3 and 5. In Class 2 and 4 cavities, although I enjoy carrying out such operations, I am willing to admit that a place exists for the use of the inlay in the hands of the average dentist. Also, I think it is less of an ordeal for the patient. A man should do that thing which he does best and, in so doing, will render the highest type of service.

In Class 1 cavities, the failure of the union of the enamel plates is responsible for the presence of caries, and we will do well to fill them immediately on discovery. This holds true for any type of cavity. When decay is extensive in this type of cavity, the walls may be broken down with a straight chisel or enamel hatchet. If the groove is narrow and decay does not extend laterally, a cross-cut fissure bur, No. 702, may be used, the fissure being cut to its entire length to lay the margin in smooth territory. The reason for this is obvious. In general, the outline form for this type of cavity in an adult tooth is a maltese cross of quite generous width, which will facilitate the use of noncohesive foil, admittedly desirable in such a cavity. The resistance form is obtained by making a flat pulpal wall with an inverted cone or end cutting bur. The retentive form is also obtained for the use of the noncohesive foil by the flat seat and parallel walls all around the cavity. It is also permissible to make a slight undercut at the axiopulpal angles to facilitate starting the gold, should cohesive foil be used. The consideration of convenience form requires but little time here, as the location of the cavity in the occlusal surface is proof enough that it will be convenient of access. If cohesive foil is to be used, one must be careful to make the mesial-axial wall incline slightly distally; otherwise, gold could never be condensed against this wall. Where noncohesive foil is to be used, the angles should be more acute, as the gold can be driven into these angles by wedging.

The finishing of the enamel walls is accomplished with a sharp chisel and the margins are beveled all around, care being taken to have the bevel greatest at the points farthest from the sulcus to prevent leaving any short enamel rods to break away under the stress of mastication. The bevel should never be made with a stone or disk as it is a great deal more difficult to make a water-tight margin against a polished surface than against a planed one.

The toilet of the cavity is now made by clearing the cavity of all chips and débris, and we are ready to proceed with the filling. Let us assume that the cavity to be filled is in the occlusal surface of a lower molar. We begin by placing in the distal portion of the cavity a cylinder of gold, rolled from half a sheet of No. 4 foil. This cylinder is stood on end and should be of sufficient length to extend up over the margin

of the cavity a trifle, a millimeter or so. This cylinder is condensed against the distal wall with a broad faced plugger, the mallet in the hand of the assistant. The cylinder of gold is held with a Black holder to prevent its rolling out of the cavity. Another cylinder is placed against the first and is condensed in the same manner, care being observed not to employ the mallet against the upper half of the cylinder, as that would tend to tip the cylinder out of the cavity. A third and even a fourth cylinder may be added, this depending, of course, on the size of the cavity. Having condensed these cylinders thoroughly against the lower half of the distal wall, we can begin the use of the cohesive foil, using a Wedelstaedt or Woodbury No. 2 long handled plugger with a slight offset or a bayonet shape, packing the gold against the pulpal wall and carrying it up against the cylinders. The gold, of course, must be held in place while this is being done. This building of the cohesive foil is continued until we have a solid mass from buccal to lingual walls, inclining the force as much as possible toward the distal on that part of the work that comes on the noncohesive gold to give it greater condensation against the distal wall and to wedge it into the angles.

The cohesive gold should be firmly wedged between the buccal and lingual walls, the operator continuing by extending the cohesive gold both on the pulpal wall and on the noncohesive gold. When the mass has become sufficiently thick and firm, the building should be continued on the pulpal wall until the mesial wall is reached and this part of the filling is leveled up, wedging also against the mesial wall. From this point the greater part of the building may be done with the direction of force in the line of the long axis of the tooth, except that it is directed to the distal wall, building on and further condensing the noncohesive foil. The final after-condensation, when the form of the tooth has been fully restored, should include the ends of the cylinders and all margins. It is my practice, in finishing the condensation of fillings of this type, to substitute a No. 1 long handled Wedelstaedt plugger for the one used in building the filling and step carefully up to and over all margins, testing for surface condensation, and, when a pit is found, adding more gold until the surface is a close knit, hard homogeneous mass, with a specific gravity approaching closely that of cast gold. The occlusal surface is now trimmed to form, usually with a No. 10 round bur, the form of the tooth being restored as nearly as possible. No attempt is made to embellish the tooth or operation with anatomic markings present at the time of eruption, but long since worn away. The rubber dam is now removed; the occlusion is tested, and the surface is then smoothed with fine carborundum stones or plug finishing burs and polished with wood points or a brush wheel charged with pumice.

Class 3 cavities occurring in the proximal surfaces of incisors and cuspids present to most of us perhaps the most difficult type of gold foil restorations. Strangely enough, it this type of operation also that we are called on most often to make. The chief obstacle here is the difficulty of access. It is imperative in this type of operation to have a sufficient amount of separation to allow for building to proper contour and for proper finishing after restoring, with the assurance that proper contact will be established when the teeth return to their normal positions. I believe there-

fore that such a filling should almost never be attempted without previous separation. The favorite method in my hands is the slow one, accomplished by the sealing in of baseplate guttapercha a sufficiently long period in advance of the operation to bring about the desired result.

The outline form of Class 3 cavities should be as inconspicuous as possible to be consistent with perfect work. Never should strength or safety of the operation be sacrificed for esthetics. The labial surface outline should be extended enough to clear the approximating tooth perfectly, the margins being brought into immune territory, and, as far as possible, the cavity lines should harmonize with the lines of the tooth. Sharp angles should be avoided. The lingual surface should be well cut back for access. Make sure there is no unsupported enamel there, as the stress of mastication, the labial surfaces of the lower incisors occluding against the lingual surfaces of the upper incisors, would soon break away this thin unsupported wall, making a fault in the filling, and a failure result.

The resistance form is accomplished by making a gingival seat that conforms to the gingival line but which is flat from cavosurface bevel to axial wall. A flat seat from labiogingivoaxial to linguogingivoaxial walls would cut into the cemento-enamel junction if carried beneath the free margin of the gum. The axial wall should be made as nearly at right angles to the gingival wall as the nature of the tooth will permit. The tooth being wedge shaped, this is quite impossible, the walls approaching each other to end in a point angle at the incisal aspect. The retentive form is accomplished by the making of sharp angles at the labiogingivoaxial and the linguogingivoaxial angles; also at the incisal angle.

The cavosurface angle of this cavity is made by beveling margins all around with a sharp chisel. The toilet of the cavity is performed, and we are ready for the filling.

This type of cavity calls for the use of cohesive foil entirely, as we do not require bulk nor do we have broad flat walls between which to condense our cylinders. With the mallet in the hand of a competent assistant, the operation is started by placing one sixty-fourth of a sheet of annealed foil in the linguogingivoaxial angle, and holding it in place with a Black gold holder or other suitable instrument in the left hand. The pellet of gold is condensed into the angle with a series of one-two blows by the mallet. The plugger best adapted to this type of cavity is the Wedelstaedt or Woodbury No. 1 or No. 2 long handled plugger, straight or with a slight offset. Successive pellets of gold of one-sixty-fourth size are introduced into the cavity through the labial opening and united to the first pellet with a series of one-two blows, the plugger being stepped toward the retention angle and at an angle of 45 degrees to the long axis of the tooth.

The gold is built about equally on the lingual-axial and gingival walls until considerable bulk has been attained, the gold extending nearly across the gingival wall. Now, the gold is filled and condensed in the same manner in the labiogingivoaxial angle, being carried back across the gingival wall to join with the mass in the linguogingival-axial area. Now we continue the building of the filling by adding successive pieces of foil, one-thirty-second size pellets, along the lingual wall, occasionally adding a pellet or two on the axial wall

to increase the bulk and strengthen the mass on its foundation. Never allow the bulk of the material in the axial portion of the cavity to become so large as to obscure the view or destroy the access to the lingual portion, or an inoperable condition will result and the filling will be doomed to failure. As soon as the incisal anchorage is closely approached, it should be filled. Building the gold along the lingual wall toward and over the incisal wall is then continued.

The line of force is now changed, being directed toward the incisal wall in order to allow the gold to flow down to and over the wall. When the incisal wall has been covered, the whole contour of the lingual surface of the tooth should be restored, with only enough gold covering the axial wall to hold the filling together. A separator can now be adjusted if desired, and the gold is built to contour on the labial surface, care being taken to step the gold toward the periphery to allow the gold to flow toward the cavity walls and over the margins.

The operation is now trimmed to form with Black's trmming knives and Black or Wedelstaedt files. The knife is used to trim and finish the gingival portion of the filling by grasping it lightly between thumb and forefinger and, with a rolling motion, gently chipping off the gold down to the contact point. Never pull or use force with a trimming knife or disaster in the form of a dislodged filling may result. The labial and lingual surfaces are trimmed to contour with the files, dragging the gold over the enamel margins. With a disk or two, the labial and lingual surfaces are smoothed and polished, and the final step is to apply the separator and run a fine strip through to polish the contact point, care being observed not to run the strip across the gingival margin and thus destroy the thin layer of cementum overlying the enamel at the cemento-enamel junction.

Class 5 cavities, those occurring in the gingival third on labial and buccal surfaces of all the teeth, are the simplest of all cavities for the use of foil, and it is in this class of cavities that gold foil clearly demonstrates its superiority over all other materials, as it can be placed easily, quickly and with less damage to the soft tissues than any other. The foil can be trimmed to a smooth surface that is in absolute continuity with the surface of the tooth, and even if the cavity should extend below the free margin of the gum when the operation is properly finished, there is no irritation of the gum tissue, and many cases have been seen by all of us in which such fillings have been in place for years, the gum in many instances completely covering the filling and being free from irritation. In this location, gold foil is truly the peer of all filling materials.

I have not dealt in this paper with the treatment of Class 2 and Class 4 cavities; not that I consider them lightly or that I do not believe in the restoration of such teeth with gold foil, for I do strongly favor its use. It is assumed that this paper will be read or heard by some who do not use foil as much as do some of us who may be more enthusiastic, and for that reason I chose to discuss the operations on Class 1, 3 and 5 cavities, and I submit to you this question: Can we do better by our patients with any other method than by filling such cavities with gold foil?

Faulty work of any kind is a waste of time, and in dentistry, it causes human pain and suffering in the remaking or repair of such work. Does it not behoove us, then, as servants in the great

profession of dentistry, to learn to do better that which we know to be best? And it is with the idea of reviving in some degree an enthusiasm for gold foil that this paper was written. I believe that the use of gold foil can and will again become popular.

840 La Salle Building.

DISCUSSION

*Arthur G. Smith, Peoria, Ill.:* To the essayist whose paper I am to discuss I accord proper praise for sincerity of conviction and clarity of technical elucidation in his presentation of what has, in times past, been regarded as the most classical subject in our annals; but with his final conclusion that "the gold foil filling can and will again become popular," I must differ. I belong to that generation of dentists whose classification as operators was, a quarter century ago, justly based on ability to produce creditable and serviceable gold foil fillings in practically every class of cavities in nearly all locations in the mouth. Within a few months, I have seen large incisal angle restorations made by my own hands well over thirty years ago. Today, I can only regard such results with feelings akin to those which assail me as I look at the old "cabbies" with their ancient steeds and old sea-going hacks as they drowse in the summer sun along Commonwealth Avenue in dear old Boston, symbol of a by-gone glory which lingers on into a day of progress and development which has, for the most part, left all such things behind as outgrown. I have not made a gold filling in eighteen years and expect never again to ask a patient to suffer the very considerable annoyance of this—to me—obsolete procedure. Let us not confuse the issue before us or make the easy mistake of assuming that because a thing is difficult of accomplishment and endurance, it automatically and inevitably follows that it is, by the mere fact of such difficulty, the best thing available for both patient and dentist. Merely because gold foil is difficult of insertion and its insertion is difficult to endure is no valid testimony or argument for its continued retention as a tooth saver. Because the automobile driver of today needs to know little or nothing of the ignition system of his machine, is he any less competent as he swiftly guides his modern distance eradicator to its destination? Let us at least have done with our obeisance to gold foil because it was always a hard subject to master. One particular form of caries must be listed as the arch enemy of the second dentition, namely, proximal decay in bicuspids and molars. Dr. Oman dismisses this entire and mighty problem with a gracious genuflexion, frankly admitting that, in this tremendously important field, the gold inlay is perhaps better suited to the abilities of the average operator. Why does a champion of the foil filling thus admit that the inlay has virtually eliminated all competition in this most difficult and important branch of our battle against caries? Obviously, because the advantages and capabilities of the inlay are so great that they can no longer be ignored by even a gold foil enthusiast. Yet, it was only a few years ago that none but the slacker among us would admit that the placing of a foil filling in even the distal aspect of a second molar was anything more than a normal operation for either patient or operator. If the gold inlay is good enough to be now admittedly our best defense against proximal decay in molars and bicuspids, it is indeed difficult to see why we should still insist on malleting foil into those simple enamel faults found in occlusal and buccal fissures where adequate protection can be given with far less trouble and expense to the patient by means of simple inlays, in no wise so difficult to install as those required by these same proximal restorations. Dr. Oman says we are money mad. To some extent, of course, this is true; it would be strange indeed to find an entire profession entirely unscorched by that fierce flame which is at present sweeping the entire civilized world! However, in the main and for most of my brothers in the ranks, I wish to enter a denial of the charge. From what has during recent years been perhaps somewhat more than an average opportunity to study and gage the efforts of my fellow practitioners, it is my very sincere conviction that never before in our entire history as a profession have we been so earnestly seeking to render to the public (to whom alone we are finally responsible) so high a grade of service on the basis of so reasonable a money return as we are now. The matter of our responsibility to the public brings me to the final point which I wish to make: Dr. Oman states that in placing

gold foil in proximal cavities in anterior teeth, while all necessary display of metal should be avoided "never should the strength or safety of the result be placed in jeopardy because of the question of esthetics." Living as we do today in an age when esthetic values govern to an enormous degree our every expression, act and purchase, we, as members of a skilled profession, should not insist on disfiguring the teeth of our patients with dots or patches of conspicuous and inharmonious yellow metal which flagrantly offends this highest of our senses (the esthetic) in one of our most conspicuous, beautiful and permanent personal adornments—our teeth. If gold foil were the only hope or means of saving the anterior teeth when attacked by caries, I would yield to no one in my insistence on its use. But such is not the case. To go into a discussion of the merits of silicates and the porcelain jacket in the saving of these teeth would lead me too far from the proper and strict limits imposed by this discussion. Today, as never before in the history of human development, the average citizen is dreaming of a beautiful, healthy and efficient body. These dreams presuppose a well kept body and an attractive personal appearance. The dentistry of today and tomorrow must meet this demand. As one who in youth took joy in as complete a mastery of this most exacting material as his individual ability would permit, I rejoice that, as a profession, we can bid it farewell as it makes what promise to be final exit from our ranks. Like the ox-cart, the armorer, the marathon runner, the sailing vessel, it was the mainstay of our life at a certain stage of our development. It carried us through a certain phase of our growth until the dawn of a day of better things. All honor to those men who developed it to its highest state of perfection: and now equal honor to those who recognize the fact that its day is done and its service practically ended. In a few short years we will look back on the mastery of the technic of gold foil, on all the details and annoyances of its insertion, with feelings closely akin to those which assail us as we stand in the solemn hush of a museum and look at a beautiful suit of armor and think of the loss to the world of all the wondrous skill which once was needed for its making—skill which inventive genius and human progress suddenly rendered obsolete.

*Roy James Rinehart, Kansas City, Mo.:* Dr. Oman prefaces his remarks with the statement that "If it is our purpose to check permanently the ravages of decay and to restore to normal contact and continuity of surface the human tooth on which we are operating, gold foil must be the material of choice." I agree with Dr. Oman in part, but not in total, for I believe that there are many cases of tooth restoration where gold foil is not indicated, and that it is quite necessary for the operator to select the case for foil rather than include all of the teeth and any surface that may be defective and attempt to restore with foil. Dr. Oman has referred to the study clubs which have been active in preserving the art of foil fillings and I desire to contribute my bit in commending the men who have persistently and unfailingly kept up their own interest in foil operations as well as adding a new recruit here and there. The ideal qualities referred to as the principles laid down by G. V. Black are as true today as when he wrote them, and it is true that no other material or method has been found that approaches these qualities. The method of adjusting the rubber dam and a plea for the nonuse of ligatures are well presented. My views do not quite coincide with those of Dr. Oman when he states that the holes punched in rubber dam for adjustment about lower incisor teeth should be three-fifths inch apart. A good rule to follow in cutting the holes for the teeth is to place the holes slightly farther apart than the mesiodistal diameter of the teeth so that the rubber dam, when placed, will not wrinkle. I grant, in the case of lower incisors with their cervical portion much broader from labial to lingual aspect, that this rule would have to be deviated from slightly, and the distance between the holes increased, or there would not be a water-tight adjustment about the necks of the teeth. Holes punched three-fifths inch apart would cause an excessive wrinkling of the dam between the teeth, which, in turn, would present a difficulty in operating procedures. I find no criticism of the preparation of the maltese cross design of Class 1 cavities, provided the entire sulcus is defective. In cases in which small pit cavities have appeared and the structure between these cavities is smooth, conservation of tooth structure is applicable, and these small places can be prepared and filled with cohesive gold with

an equal amount of permanency. Dr. Oman in his consideration of convenience form for Class 1 cavities states that "if cohesive foil is to be used, one must be careful to make the mesial wall incline slightly distally." This, I believe, to be an error, for the mesial wall should be inclined slightly mesially, sloping toward the marginal ridge, which will give convenience and certainty in packing gold against this wall and the mesiopulpal line angle of the cavity. In cases of extensive decay in Class I cavities, it would be impractical to have the mesial and distal walls parallel, but they should rather be inclined mesially and distally, respectively, which will afford an adequate amount of dentin to support the marginal ridges. There is nothing that can be added to or taken from the clear and concise method in which the essayist has described the Class 3 or 4 foils. Dr. Black's theory is that the gingival seat should be placed beneath the gum for the purpose of taking advantage of the anatomic shape of the tooth, which allows for a wide base labiolingually, giving the greatest amount of resistance and stability to the restoration. The building of a proper contact is one of the most important steps in the procedure in foil work as it is in any other restoration. I am in hearty sympathy with the statement in the paper criticizing the "easier" and the commercial way. In our pursuit of progress, we often wander from the truth in an effort to find something easier or more profitable. The general use of silicates is most unfortunate, and while they have a place in the practice of dentistry, their use is subject to very much abuse. The most careful manipulator of the silicate filling finds that his beautiful restoration is far from perfect in the course of a very few months and, in some cases, even detrimental. The great piece of art, demanding the greatest amount of skill in operative dentistry, is the foil filling. The dentist who has developed skill in foil technic can accomplish successfully almost any other dental operation. The mastery of the art has a refining influence on the operator and we find, in nearly every instance, that these masters are true to their profession. Foils have stood the test of time, and it is to be deeply regretted that so many of the profession within the past twenty years have felt that foil no longer has a place in their practice. However, in the past few years, the graduates of practically all of the schools in the country have been thoroughly instructed in foil work and have been required to insert a generous number of all classes of foils and to become as proficient in the technic as in any other dental operation. When the mouths of patients who have foil properly inserted and beautifully finished are inspected, we would be blind to the opportunities of foil work if we did not appreciate the wonderful service they have rendered. Such mouths present an artistic, serviceable and clean-cut appearance rarely found where the restorations consist of inlays and silicates.

*Dr. Oman (closing):* Has gold foil thus been replaced by something better? I admit gold foil is not becoming popular, because we have attained such speed of living that we cannot include everything in our lives that we should include, and consequently we rule out some of the things we ought to include. Some of the better things of life are being crowded out by things which are only more alluring on the surface and not more enduring. With respect to the location of the filling: I will agree that the location of the filling is to be given careful consideration. I don't consider myself an expert in the use of foil in molars or bicuspids, but I would use it where the case seems to require it. If foil can be used without too great a display of gold, I would say, use it. Dr. Smith states that teeth are being preserved permanently by the use of inlays and silicates. I don't believe that that is possible. Even if we don't become experts in the treatment of bicuspid and molar cavities, there are a great many things to learn as far as the saving of the anterior teeth is concerned, because they are the most prized possession of a great many people. The assertions in my paper were considered carefully before I made them. The discussion of Dr. Smith was interesting, even though we do not subscribe to it. Criticism in any form is a great thing for the progress of the profession, if it is constructive and not flattery, out of which nothing can be developed. I think that there are few here who will join in the obsequies for gold foil. The lack of access is another thing to be considered. Dr. Black's principles will continue to be true as long as time. He takes exception to my statement that the dis-

tance between the holes is too great in the lower incisors. If you will picture the lower incisors you will realize the gingivae comes up quite high, and when we allow for the rubber to cover the gum I believe you will see that it is necessary to prevent a secretion of saliva through the rubber. I think there is a misunderstanding on the part of Dr. Rinehart. He stated that the mesial wall should be inclined slightly mesially, sloping toward the marginal ridge. I stated that the mesio-axial wall should incline distally, that is, viewing the cavity from the occlusal surface. At any rate we agree that access is the prime requisite, and the mesial wall should slope toward the occlusal and in a line with the handle of the plugger as used in condensing the foil. The dentist who has developed skill in foil technic can accomplish successfully most any other dental operation. I thing it is a great help in all other work. Dr. Rinehart says also that the schools are beginning to teach gold foil work. Now, if there is no value to it and it means nothing to the public, why would the best brains in our profession teach it to the younger generations? Why would they think it worth while? I believe that gold foil is coming back in use; possibly it will not arrive in the next five or ten years, but there is a leaning toward it through, I think, the dissatisfaction of many men with the things they are now doing. If the methods are too difficult I think they will be simplified, and be developed so that they can be handled correctly.

# SURGERY OF THE ALVEOLAR PROCESS AND TOOTH EXTRACTION*

By J. P. HENAHAN, D.D.S., Cleveland, Ohio

OUR views on extraction as well as the technic for its performance, are largely an inheritance from the past. Our ideas and habits pertaining to it are deep-rooted from custom, but in view of present-day knowledge, some of these ideas and customs must be modified.

From the modern point of view, the dentist must consider any extraction as a surgical procedure and treat each operation in that light. Research has given new importance to extraction surgery, and it is the duty of the profession to employ this knowledge.

Because of the necessity for speed in the past, research was neglected, but, today, anesthesia of one form or another can be applied in any case and permit its completion with care and precision.

The importance of scientific dentistry is fully recognized by the medical profession, and, today, all medical clinics include a thorough examination of the oral cavity and teeth as a necessary step in medical diagnosis, and rely on the dental profession for assistance in the elimination of dental infection when it is discovered.

Many forms of systemic disease which the diagnostician formerly referred to as of vague origin today are traced to a dental source of infection. In the recognition and eradication of such foci, the dentist assumes great responsibility, and, under the circumstances, he must be capable of logical reasoning as well as skilful in the manipulation of the oral tissues.

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 22, 1928.

If we are to cooperate with the medical profession in such cases, it will be expected that, when we operate for the removal of the source of chronic infection, we must do so systematically and according to surgical principles, and in a manner that will reveal all knowledge of existing pathologic conditions in the involved area. If this is to be the case, it can be accomplished only through the application of definite operative methods.

The task before us, therefore, as a profession, lies in standardization of extraction procedure.

During the last few years, we have developed a degree of finesse to our operations through the practice of process trimming.

Novitsky and others during the last few years have described an operation whereby pulpless teeth in many cases can be extracted with less difficulty by removing a section of process which covers the roots.

This suggestion was quickly grasped by many operators, and the operation unfortunately sometimes carried to extremes. As might be expected, some of these experiments were responsible for bad results because the procedure followed was ill-advised and radical. However, even mistakes have helped toward progress, as they have demonstrated features which must be avoided.

At this time, after several years of trial, the profession are accepting the procedure as one of merit, and many believe that it should be resorted to after all extractions and especially in preparation of the mouth for dentures. Clinicians familiar with results of such operations state that conservation should be the keynote and that radical procedure is seldom justified.

MacMillan has pointed out that, contrary to older teaching, the alveolar process is not a transitory tissue destined to survive only as long as it supports natural teeth. He states that, after extraction, its function is restored when well-fitting dentures are placed upon it, and is destroyed only through irritation or infection. He also states that the alveolus, after extraction, when not the seat of infection, becomes calcified and upon examination resembles the rest of the bone. Experiments under certain conditions bear out these statements. This he advances as a reason why alveolectomy so extensive as to obliterate the alveolus should not be performed. In fact, radical procedure should be resorted to only in those extreme cases in which abnormality exists, such as pronounced protrusion or enlargement of the process. In these cases, it is sometimes necessary to remove considerable process for esthetic effect or to make denture construction possible. In these cases, the process resection is designated as alveolectomy.

In the average case, procedure should be limited to trimming off the sharp cervical process edges and projecting points of the interdental septums and careful reduction of overhanging ledges on the buccal or labial surfaces of the alveolar ridge, to facilitate the withdrawal of an impression and the insertion of a denture. When reduction is confined to these limits we are in reality doing only that which Nature herself would accomplish by the slow process of absorption. (Fig. 1.)

Earlier operators recommended extensive alveolar resection in all cases when the mouth was prepared for dentures. It was advised that the alveoli be obliterated by removal of the labial or buccal walls of each alveolus and their

interdental septums as far as the apical area, the belief being that bone regeneration would quickly fill remaining depressions and create a beautifully formed ridge. Unfortunately, it was found, in many cases so treated, that instead of bone deposit, resorption still further reduced the alveolar ridge, with disastrous results.

### ALVEOLOTOMY

Alveolotomy is of value in single extractions in which extreme difficulty is met. The bone which covers the labial and buccal surface of all teeth except the lower molars is quite thin;

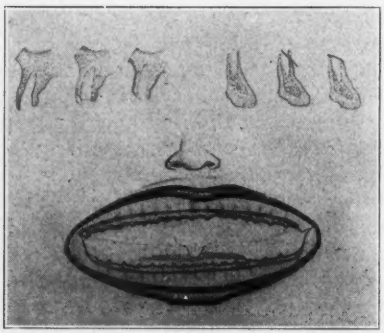

Fig. 1.—General outline of alveolar ridge, showing the extent of cervical bone to be exercised.

nevertheless, in all cases, it locks the root into the socket. Careful excision of part of this lamella vastly simplifies single extraction, with prevention of injury to roots of approximating teeth as well as soft tissue. This method will be found to have particular merit in the case of pulpless teeth.

Care must be taken not to tear or lacerate the gum and periosteum in raising it. Incisions carefully planned will prevent this. (Figs. 2-3.) After operation, the tissues should be carefully placed back and massaged to position, displacing air, débris or blood clot from between the flap and the bone. A single suture will hold the flap margin in position.

In preparing a mouth for dentures, it will be observed that there is a pronounced difference in the quality of the alveolar process in different individuals. In some, the bone is very dense and unyielding. It heals slowly, but afterward stands sturdily without much evidence of resorption. This type of process gives little trouble to the prosthetist.

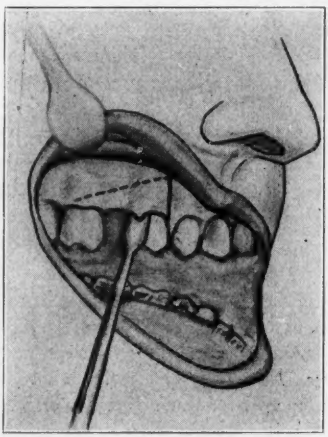

Fig. 2.—Vertical incision and method of retraction of soft tissue for removal of upper first molar roots.

An opposite type is soft and spongy throughout. It has a thin cortical layer and heals quickly. This type of process does not withstand the least irritation, and if there is the slightest departure from a perfect adaptation of a denture, additional resorption quickly takes place. When, therefore, process trimming is being done in a case in which the bone is found soft and spongy, conservation

is indicated and only the slightest smoothing resorted to.

Alveolotomy, when successfully performed, affords beautiful results in the shortest possible time, and, in addition, the patient does not suffer nearly so much postoperative discomfort and pain as in the case when it is not performed.

Dentures can be constructed in approximately two weeks. It is reasonable to suppose that resorption will eventually loosen some dentures made as early as this, but, even so, in the meantime

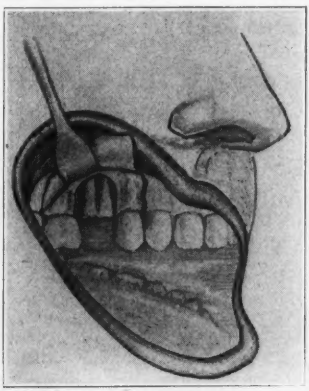

Fig. 3.—Roots of upper first molar exposed after soft tissues have been incised and retracted and the buccal plate removed.

they are much more satisfactory than the old-fashioned temporary plate.

### LOWER THIRD MOLAR

The lower third molar provides the dentist with many problems. It is found impacted in a limitless variety of conditions, and, still more frequently, it is found malposed, incompletely erupted, retarded in eruption or crowded distally beyond the alveolar process and erupting through muscle instead of gum tissue. It usually marks the difference in age and development between younger and The lower third is, indeed, seldom found normal in every respect.

These conditions prevent the application of ordinary extraction methods, and special technic must be designed to fit each particular case. Many oral surgeons and extractors have described operations designed for the removal of the impacted lower third molar.

It must be remembered, in dealing with these cases, that a great difference is found in texture and density of the alveolar process in different patients.

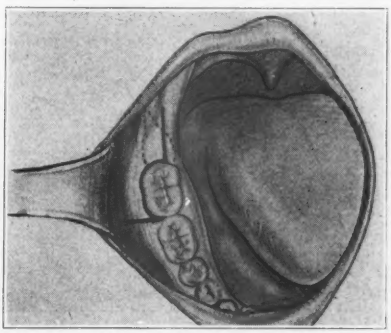

Fig. 4.—Method of incision of soft tissues preparatory to removal of an impacted lower third molar; also after flap has been returned to normal position.

older persons, but chronic infection also is often responsible for unusual density and hardness. In youth, the bone is pliable and yielding and, for this reason, operations for removal of impacted teeth are accomplished more readily than in older persons.

The natural outline of the lower third molar when normal in shape and position describes a moderate curve from cusp to root apex with anterior convexity. This, and the fact that no tooth

locks it distally, simplifies its extraction in practically all cases if it is not impacted, even though eruption has been incomplete or retarded, provided its position is approximately parallel to the second permanent molar.

Extractions of this type are most readily accomplished by applying an elevator anterior to the tooth between the mesial root and the process. It should be inserted deeply into the cancellous bone so that the process becomes the fulcrum when pressure is exerted. The second permanent molar should not be made the fulcrum, for obvious reasons. The third molar, in the great majority of these cases, will simply follow the curve of the alveolus and uncurl itself out of the socket.

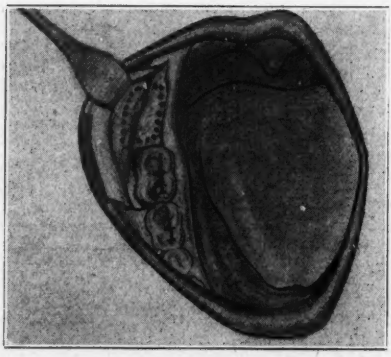

**Fig. 5.—Soft tissue flap retracted and drill perforations made preparatory to removal of bone section to expose impacted lower third molar.**

In older patients, the bone is naturally denser, and frequently tooth malformation exists. The technic in such cases requires more patience, and bone cutting is necessary. When these conditions exist, great and sudden force should be avoided.

In the case of an impacted lower third molar, as stated before, the conditions found will govern the operating technic.

In youthful patients, the bone is found quite pliable, and in cases in which the crown has partly erupted through the process, or the position of the tooth is at a moderate angle, it will create a path for itself through the bone when an elevator is carefully applied and manipulated.

In these cases, the same result takes place that occurs in ordinary extractions. That is, the process walls spread and the cancellous tissue is squeezed by the pressure of the moving tooth.

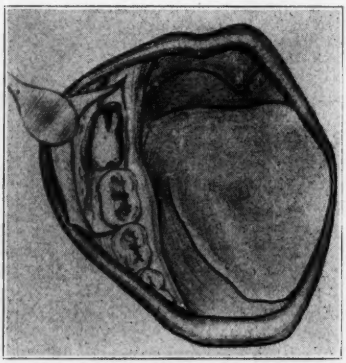

**Fig. 6.—Overlying bone removed in the exposure of lower impacted third molar.**

In complicated cases in young persons, cortical bone is sometimes removed for the purpose of uncovering the crown or one side or a partly impacted lower third molar. A hand chisel, a chisel driven by a mallet or a bur will expose the soft bone, after which pressure is applied to the tooth to lift it up through the newly created opening.

In complicated cases, such as in bad position and in mature patients, in

which the bone has become dense and hard, we must realize that conditions exist which require cautious procedure. Such patients must sometimes be operated on in the hope of relieving chronic nervous or organic symptoms.

In these cases, it is necessary to remove a section of bone for the purpose of exposing the teeth, but when this is neatly done, the wound quickly heals with complete restoration of bone.

The method which I advise eliminates the necessity for speed and exposes the entire field to view. It consists of definite incision and retraction of the soft tissue. A vertical incision anterior to the second permanent molar and a horizontal incision distally from the second molar and over the impacted tooth will form a good outline (Fig. 4); then the gum and periosteum are lifted from the bone at the side of the second molar as well as from the bone covering the impacted tooth. A retractor is placed between the bone and loosened soft tissue to hold the flap back; then with a two-bladed bone drill, a series of perforations are made through the cortical layer of bone overlying the tooth, and along the outline of the bone section to be removed. (Fig. 5.) Each perforation is then united with the next, a continuous line being made and the bone removed. It is necessary that two-thirds of the tooth be exposed, to allow it to come away without difficulty. (Fig. 6.)

After the operation, all débris is thoroughly removed. To allow it to remain is to produce infection, delay healing and cause the patient unnecessary discomfort. The soft tissue flap is then replaced in normal position and held with one suture.

POSTOPERATIVE TREATMENT

Postoperative treatment is often as important as the operation. Many factors enter into it, ranging from simple local hygienic detail to consideration of the general health of the patient. Therefore, the methods to be employed in treatment are decided according to the conditions of the tissues involved in the wound, or by the state of health of the patient, or by both.

The object of postoperative treatment, therefore, is twofold: (1) prevention of infection in the wound or control of infection already existing, and (2) prevention of pain and consequent strain on the nervous system.

The selection of remedies for the alleviation of pain demands serious consideration. In postoperative dental cases, it may be the result of bacterial irritation or trauma, or a combination of the two.

Sometimes, we see a patient who has delayed for many days the extraction of an infected tooth or teeth in an active state of suppuration. These patients often show signs of septic poisoning with fever, mental dullness, fetid breath and constipation.

When a number of infected teeth are present and the symptoms take chronic form, such as rheumatism or neuritis, we may suspect that the patient's resistance has broken under the long continued attack of infection.

In these cases, it is wise to proceed cautiously, removing only a small number of teeth at the first operation. It must be remembered that an infected pulpless tooth which has been present for a considerable time has also contaminated the adjacent bone, and it is in this bone, after extraction, that reaction takes place, a great quantity of

toxins being suddenly liberated into the blood stream. In the patient with resistance and immunity already impaired, this sudden toxic flood may be too much for the organs to withstand.

It is also a wise precaution to put these patients to bed for forty-eight hours after operation to prevent overexertion and fatigue. The wound in these cases should not be packed, unless it is painful, and even then only loosely dressed.

When, during a complicated extraction, the bone surrounding a pulpless tooth is found to be sclerotic, it is reasonable to anticipate reaction. In these cases, it is wise to lift up the periosteum and open one side of the alveolus by the use of a rongeur forcep. This removes only infected bone, which delays healing and which would be wholly or partly absorbed in any case. The object of opening the side of the alveolus is to create a gate through which the roots will pass and through which a blood supply can immediately enter the alveolus, encourage granulation and eliminate, in many cases, what is commonly known as dry or septic socket.

If wounds are large or much bone or soft tissue laceration has taken place, it is a good procedure to fill the wound loosely with a gauze strip dipped in a solution of essential oils and guaiacol. This dressing, which is antiseptic, deodorant, anesthetic and stimulating, controls infection and prevents pain.

As stated before, pain might be the result of either trauma or bacterial irritation, or a combination of both. In traumatized cases, a necessary remedy for pain consists of thorough elimination of all débris or irritating bony spicules projecting themselves into the inflamed soft tissue or gangrenous soft tissue. A spray of parasthesin powder will allay the pain and soreness and produce anesthesia, permitting the operator to perform this work thoroughly.

When the pain is due to bacterial infection reacting in the wound from twenty-four to forty-eight hours after extraction, the socket should be cleansed of all débris and blood clot and afterwards dried and loosely dressed with a camphor-phenol antiseptic. In the great majority of cases, the pain will be controlled by this procedure in a short time. After a few days, when the pain has subsided, the packing may be discontinued and the wound treated with argyrol or analin dyes for the purpose of stimulating granulation.

Hot poultices, pads or hot water bottles should not be applied to the face after extractions, as they invariably cause a marked swelling.

After the removal of impacted lower molars, in which deep cancellous bone tissue has been opened, antiseptic dressing should be resorted to as a measure to prevent infections invading the bone. The blood clot seldom remains organized in these wounds and muscle action often destroys and removes it even after ordinary extractions. For this reason, it is necessary to resort to dressings after lower third molar extractions more frequently than will be found necessary after extractions in other parts of the mouth. This is so because, in addition to the breaking down of the blood clot, secretions drain into wounds of the lower jaw. When socket walls are destroyed and dressings are necessary, they should be continued until granulation has progressed sufficiently to protect the wound.

After operation for the removal of the lower third molar, patients should immediately be cautioned against keeping the jaw inactive. They should be

instructed to exercise the jaw to the usual extent and open it as wide as possible several times during the day. If this precaution is neglected and the jaw remains inactive most of the time, the mouth becomes foul and the wound infected.

Suturing of wounds should be resorted to only when necessity requires it. Unnecessary suturing often converts a simple case into a complicated one. It must be remembered that wounds inside the mouth are never aseptic. Suturing prevents drainage by binding down the tissue, and infection developing under tightly sutured flaps results in tension, swelling and pain.

In postoperative treatment, we also have a great field for cooperation between the dentist and the physician, and in cases of systemic disease or infection, the patient's welfare is often best protected by coordinated service from both, and when there is a possibility of pronounced reaction, we should advise the patient to call the physician before rather than after reaction has begun.

In our capacity as dental oral surgeons, we see many patients who apparently are in good health, but who nevertheless are upset after extraction operations and anesthesia. Many are nauseated and still others complain of headache. Nauseated patients should be allowed to lie down quietly for a time. When the condition does not improve, 30 drops of aromatic spirits of ammonia in 2 ounces of cold water will be of help. It is a remedy which neutralizes the stomach contents and is of benefit whether expelled or retained. In the more aggravated cases, 10 grains of chloratone in capsules will alleviate the condition in ten or fifteen minutes.

Headache or neuralgia or pain in the operative region will be relieved by the administration of analgesic drugs such as the derivatives of salicylic acid or acetanilid or phenetidin. Drugs of the barbaturic acid series are also employed for their hypnotic and sedative effects, and are given to the patient to induce sleep.

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DISCUSSION

*James A. Blue, Birmingham, Ala.:* A plea for a speed limit should impress every one who is called on to extract teeth, as haste is dangerous. A technic should be employed which is accurate and effective with the operator as master, at all times. This is not possible with poor anesthesia, whether local or general. All cases should be diagnosed before the operation is attempted. Neglecting this point is the basis for many failures. It is now a universal practice after teeth are extracted to give the alveolus some surgical attention. The sharp margins of process should be removed, merely the overhanging edges, as Dr. Henahan has emphasized, the interseptal bone being conserved as much as possible, as well as the dental lamella, so that regeneration of bone will take place. I trust that the ruthless destruction of the alveolus under the guise of alveolectomy is a thing of the past. Of course there are exceptions to this rule, as in extreme cases which Dr. Henahan has pointed out. In cases of so-called surgical removal of one or more teeth, the flap design should be such that it may be placed in its original position after operation, and held by a minimum number of sutures until regeneration of the osseous structure is complete. The method of designing flaps for operating on the lower third molar is thoroughly approved, and I cannot emphasize too strongly this open view technic, enabling the operator to work with minimum trauma to the bone, which is important in these cases. I have always condemned burs as instruments for removing bone, but the drills which Dr. Henahan describes cut rapidly without producing excessive heat. It is advantageous to play a stream of warm saline solution on the drill while the cutting is being done. This water may be removed with an aspirator, which keeps the field clear and clean. Postoperative treatment is just as important as the operation, and is essential in many cases. After long and tiresome

operations, the patient should receive a sedative, and any local treatment which is deemed necessary by the operator should follow. It has been my observation that most postoperative pain after the first twenty-four hours is due to the invasion of pathogenic bacteria, which destroys the normal blood clot. A method which I have found to be effective is to spray the socket with physiologic sodium chlorid solution or sterile water, swab with mercurochrome and fill the socket loosely with plain gauze tape, which has been saturated with a solution composed of the following drugs: butyn, 5 per cent; butesin, 20 per cent; oil of cloves, 30 per cent; ether, 17.5 per cent; alcohol, 27.5 per cent. This procedure should be repeated every forty-eight hours until healthy granulation has taken place. Dr. Henahan states that no dressings or packings are inserted where wounds are made for free drainage in cases of acute septic reactions of dental origin, but I find it advantageous to place an iodoform wick in these wounds for twenty-four hours, as this tends to retain the opening, and permits free drainage.

*George Schneider, La Salle, Ill.:* In the extraction of the first upper molar, instead of the extensive operation of making that flap and removing all of the hard tissue up to the apex of the roots of the tooth, why not remove about one-third of the alveolar process, separate the roots and pick them out separately? Or, in other words, why not separate the labial root and take out the buccal roots with the crown and the labial root afterwards?

*H. A. Elmquist, Des Moines, Iowa:* I wish to take exception to one point, and that is using a bur when it is thought that a root has been pushed up into the antrum. A bur is too uncertain to be used in that position. I would much rather use the chisel with the mallet, and have absolute control of the field of operation at all times. And we must not jump to the conclusion too quickly that the root is actually in the antrum if a root gets away from us. In most cases, it is pushed between the antrum mucous membrane and the bone, and, by careful observation of the field, we may enlarge the opening and retrieve the tooth without having to penetrate through the mucous membrane of the antrum.

*Roy S. Hopkinson, Milwaukee, Wis.:* Dr. Henahan's paper is a balance wheel for some of the men who get ambitious about surgery and are too radical. Much of the criticism of so-called alveolectomy is justified because men do not understand the principle involved in so preparing the mouth that it will afford an adequate foundation for future reconstructive work. It takes a man like Dr. Henahan to sound the warning to the young man whose experience has been rather limited, but whose ambitions are unlimited. Dr. Henahan said that suturing many times makes a complicated case out of a simple one. That is a rather broad statement, because the only objective I know of in putting in a suture is that it may act as a matrix to help hold the blood clot in place. I cannot see any other function for it so far as the particular simple case he is talking about is concerned. In the method of retraction of the flap, to say that "you must not retract the flap more than one-eighth inch" will perhaps give the wrong conception of an alveolectomy. I cannot quite understand how a man could retract a flap one-eighth inch and remove a large cystic mass that was located far above the apical area of the tooth involved. Dr. Henahan is trying to convey the idea that, in the case that is not complicated by pathologic conditions of extensive nature, there is no necessity to retract a wide flap. But he should have mentioned that in cases in which there are multiple areas of pathologic tissue, it is necessary to retract that flap much farther than was indicated in his technical drawings, in order to visualize the field. One of the discussers' papers mentioned a paste that contained alcohol. I believe that pastes with dehydrating agents in them should be discontinued for all time to come as far as tooth sockets are concerned. There have been many pastes manufactured and sold to the dental profession that retard regeneration of tissue more than the pathologic condition that was there before the tooth was removed.

*Dr. Henahan (closing):* In explanation of Dr. Blue's reference to burs, I will say that the ones I use are not of the ordinary dental type but a surgical bur intended for bone cutting only. It consists of two blades and two grooves and is self-cleaning. It really is a drill rather than a bur. It makes large flakes which are quite visible and easily cleared away in prophylaxis of the wound. Dr. Blue also referred to the difference between a wick and a dressing. There is a

difference, of course, and usually a wick is placed to assist the discharge of pus in cases in which a dressing or packing would prevent drainage. Dr. Schneider has asked, "Why make this operation so extensive?" The object of the operation described is to prevent it from becoming extensive. To raise a flap of gum tissue and place it back again is a very simple procedure. It conserves soft and bone tissue because it exposes to view the very part involved in the operation. It prevents lacerations, bruises, scars and sloughs, and when we do this, we decrease rather than increase the extent of the operation. Dr. Schneider evidently has in mind the alveolar forceps. This instrument should be relegated to the realm of all other obsolete instruments. It was a crude thing and much tissue was needlessly destroyed by its use. Dr. Elmquist evidently understands that I recommend a large engine-driven bur for opening into the antrum through the socket. The bur is a hand instrument. I consider it superior to a chisel, because the slowly moving bur leaves a well-defined bone margin, whereas the chisel leaves uneven points and angles which must be smoothed with other instruments. Roots are occasionally lost between the bone and the periosteum of the antrum floor, but usually the root enters the antrum. This accident often occurs because an abscess intervenes between the tooth end and the antrum floor, creating an avenue for roots to pass through. In these cases, the large antrum bur on a solid handle creates the ideal opening—a definitely shaped opening with even smooth margins—into the antrum. The alveolotomy slide which Dr. Hopkinson refers to could have been more elaborate and have shown the gum tissue and lip with more detail. In consequence of this, he understood the illustration to refer to a flap instead of the cervical bone margin.

# PROLIFERATING HYPERTROPHIC GINGIVITIS: REPORT OF TWO CASES ACCOMPANIED BY SEVERE ANEMIA*

By ISADOR HIRSCHFELD, D.D.S., New York City

As specialists in periodontia, the members of this Academy are not infrequently called on to diagnose and treat very unusual and severe periodontal diseases or periodontal symptoms of systemic disease. Yet it will be admitted that, up to the present time, aside from the stereotyped conditions that are found in our textbooks, comparatively little has been taught in our medical or dental schools to aid us in this direction. Both professions are still quite in the dark regarding many pathologic phenomena that present themselves in the mouth, especially those involving the gums. It is not strange, then, that the periodontist is often in a quandry as to proper diagnosis and treatment, and even medical aid cannot at times help him in solving the clinical puzzle pictures. As a matter of fact, such conditions are occasionally referred to him by the physician for consultation.

Although it is true that the periodontists is apt to get more such cases than is any other practitioner, certain conditions occur so rarely in his individual practice that he is deprived of sufficient opportunity to study them. It is logical then to believe that a pooling or an interchange of experiences and observations on unusual cases by many of our members should be advantageous and should result in much scientific enlightenment

*A Contribution to the Annual Report of the Committee on Scientific Investigation, read before the American Academy of Periodontology, Detroit, Mich., Oct. 21, 1927.

and clinical progress. Therefore, as a member of the Committee on Scientific Investigation, I wish to suggest that, if my expression meets with the approval of this Academy, special and ample time be hereafter set aside on our annual program for such a purpose. It is with this idea in mind that I present the following two interesting cases, each of which shows a marked acute hypertrophic and proliferative gingivitis, accompanied by a severe anemia.

Fig. 1 (Case 1).—Photograph taken July 5. While the papillae alone appear hypertrophied, close observation will show that the entire gingiva is thickened. In contrast with gingivitis due to local irritation, the points of the papillae here are markedly pale instead of red. On the lingual side, the gingivae were less hypertrophied. Hemorrhage may be noted between the upper left central and lateral incisors.

## REPORT OF CASES

CASE 1.—Mr. G., aged 28, single, traveling salesman, about May 1, 1927, began to suffer from slight bleeding of the gums. This was for a time controlled by rinsing with cold water, but, a month later, the gums commenced to ooze blood continuously. He visited several dentists without getting relief. July 1, he was referred to me. The condition of the mouth was unhygienic, this no doubt being aggravated by the recent lack of function. (Fig. 1.) The gums were tender, especially to hard food, were bluish pink, and were somewhat hypertrophied generally, except on the lingual side of the lower anterior teeth. The interdental papillae were all hypertrophied and had a tendency to assume a conical shape with their points very anemic. They were semi-rigid and could be partly turned away from the teeth.

The lower right second bicuspid, and the first and second molars were missing, the third molar being left in an isolated position, this making it possible for me to see that the hypertrophy was equally marked all around the tooth. This fact indicated that the swelling of the gingivae in the rest of the mouth did not necessarily focus from the interproximal papillae.

Fig. 2 (Case 1).—July 21, when the gums were at their worst. They are much more hypertrophied and pushed away from the teeth by extensive areas of subgingival proliferation all over the mouth, some of which can be plainly seen here on the right side. At first red, they soon matched the gingivae in paleness.

The interproximal papillae between the upper right second bicuspid and first molar and between the first and second molars, also between the upper left second and third molars, were punched out in appearance, tender to touch and bled quite freely. These areas, particularly, influenced me at first in the diagnosis of probable Vincent's infection that had been improperly or incompletely treated. In addition, there was hemorrhage from between the upper anterior teeth as well as between the lower left cuspid and first bicuspid. Between the upper left central and lateral incisors, it

was constant and copious enough to keep the lips covered with blood.

Smears were positive for Vincent's organisms. The patient's face had a greenish pallor focusing from the tip of the nose. He felt tired, but otherwise had no systemic complaint.

After an application of 10 per cent neoarsphenamin in glycerin and the home use of sodium perborate as a mouthwash for four days, the patient returned, July 5, with the tenderness of the gums and the bleeding reduced except between the upper left central and lateral incisors, where the hemorrhage still continued. This condition remained the same for two days more. A culture made at this time showed the presence of *Staphylococcus aureus, Streptococcus mucosus* and rod-shaped bacilli, gram-positive.

The persistence of the steady hemorrhage, the hypertrophy, and especially the paleness of the points of the papillae, in their ensemble, suggested, at this time, the possibility of an acute lymphatic leukemia. It is a known fact that, in about 5 per cent of cases of this disease, there is to be found very marked gingival hypertrophy. I have seen such cases in hospitals, but, in each instance, the condition was advanced and the gums covered the teeth almost completely. I had never seen the gums in the incipient stages of the disease, but the logical deduction was a picture similar to that presented by this case. Therefore, a blood count was made, with the following findings: hemoglobin, 50 per cent; erythrocytes, 2,624,000; leukocytes, 4,600; parasites, none; small lymphocytes, 21 per cent; large, 77 per cent; nucleated red cells, 2 per cent; coagulation time, 0 to five minutes. The pathologist's diagnosis of the condition was "Marked secondary anemia with lymphocytosis (large cells predominating). This picture is one of an acute lymphatic leukemia in stage of remission. Aplastic anemia must also be considered."

The patient was immediately referred to his physician, and, several days later, was sent to Roosevelt Hospital. In the meantime, he became weaker, the hemorrhage increased and his mouth was quite sore and uncomfortable. The soft palate and the retromolar mucosa, as well as the end of the uvula, were discolored, as if bruised. Several of the interdental papillae became

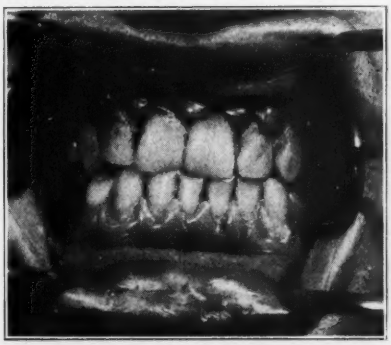

Fig. 3 (Case 1).—Appearance of mouth, September 13. The gingivae are not yet normal in shape, though the hypertrophy is greatly reduced. The proliferative tissue is still to be seen under the upper papillae. The points, though slightly anemic, are pinker than at the patient's first visit. Hemorrhage is not in evidence anywhere. After a general cleansing at this time, proper instructions were given in mouth hygiene, and, within a month, form and color returned to normal.

Fig. 4 (Case 2).—First photograph taken. The flap of hypertrophied gingiva opposite the lower incisors is pushed away from them by inflammatory tissue. The beginning of a similar condition can be observed between the upper right central and lateral incisors. In the alveolar gingiva between the lower right central and lateral incisors, a fistula leading from a deflated gingival abscess can be seen.

still larger now and were pushed out of contact with the teeth by proliferating subgingival inflammatory tissue which was of a deeper color than the gingivae. When he entered the hospital, a tentative diagnosis was made of a possible leukemia, purpura, scurvy, or agranulocytic angina. He continued to grow weaker. The inguinal, axillary and cervical lymph nodes became hard and enlarged, and he developed hemorrhages in both eye grounds. When I observed him, July 21, I found a left peritonsillitis with a large slough along the tonsil and a greater swelling of the gums, which felt especially sore at the places where the subgingival inflammatory tissues developed continuously. (Fig. 2.) These subgingival areas of proliferation were now almost as pale as the gums themselves. The odor from the mouth was sour, pungent and so strong as to be

Fig. 5 (Case 2).—Lingual side. This photograph which was taken at the same time as Figure 4 shows a bright red linear area of demarcation separating the necrotic tissue from the hypertrophied gum. This part was quite tender and bled easily when touched.

almost unbearable to the observer. At this time, the blood count was at its worst: hemoglobin, 18 per cent; erythrocytes, 1,600,000; leukocytes, 25,800; polymorphonuclears, 3 per cent; small lymphocytes, 13 per cent; large lymphocytes, 81 per cent; basket cells, 2 per cent; basophils, 1 per cent.

On the next day (July 22), he received the first of a series of four blood transfusions. In about a month, he was discharged from the hospital feeling quite well and with his gums very much improved, but he was advised by Dr. Everett Dulin, the house physician, to return frequently for blood examinations. He carried out these instructions, and, at each successive visit, the examinations showed progressive improvement.

The patient improved sufficiently to be able to return to business. He seemed to enjoy good health and gained about 10 pounds, being up to his normal weight. The gums were practically normal in color, form, and function. (Fig. 3.) November 11, the blood count was at its best: Hemoglobin, 93 per cent; erythrocytes, 5,000,000; leukocytes, 7,000; polymorphonuclears, 49 per cent; transitionals, 7 per cent; large lymphocytes, 42 per cent; small lymphocytes, 2 per cent.

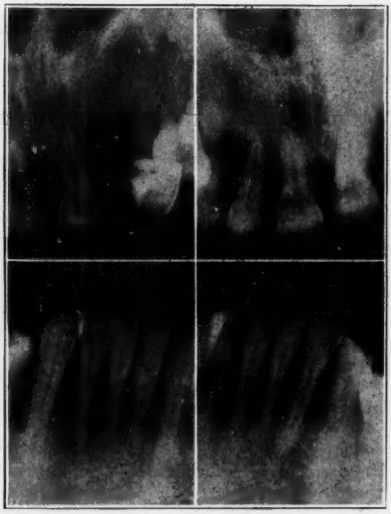

Fig. 6 (Case 2).—Advanced alveolar destruction in the anterior part of the mouth where most of the gingival proliferation and abscesses were found. In the posterior part, destruction is slight; yet there, too, the gingiva looked and felt quite pathologic.

December 3, he returned to my office considerably worried because his toothbrush had become pink on the two preceding days and on that day the saliva was also pink, while the marginal gingiva opposite the left lower first molar was slightly swollen, cyanotic and tender, as was the tooth on percussion. A smear revealed no Vincent organisms. A roentgen-ray examination of this area re-

vealed destruction of the alveolar crests in the bifurcation of the molar, and of the septal crest distally to the tooth; also, that the root canals were partly filled and there were areas of periapical radiolucency. A blood count made this day indicated a possible return to the original condition: hemoglobin, 84 per cent; leukocytes, 16,000; erythrocytes, 5,150,000.

Sodium perborate was again prescribed, but, December 5, although the gum was less tender and the swelling reduced, the bleeding was worse. The septal gingivae were again anemic at their points. On the right cheek, opposite the cuspid, the mucous membrane showed a black blister, and there was a similar one on the lip opposite the upper central incisor. On the recently shaved skin, numerous jet black spots were conspicuous. The tongue showed a slow constant oozing of blood to the left of the median line, near the anterior third, but no lesion could be seen. The patient was readmitted to the hospital the next day. At this time, he also had ulcers on both cheeks from which blood was oozing slowly. The throat was negative. The white cell count jumped in the three days from 16,000 to 76,000. The complete count was: erythrocytes, 5,000,000; leukocytes, 76,000; neutrophilic myeolocytes, 85 per cent; polymorphonuclears, 3 per cent; large mononuclears, 2 per cent; lymphocytes, 10 per cent.

The patient failed rapidly. The bleeding of the gums and cheeks was entirely uninfluenced by treatment, either local or systemic. The former included sodium perborate paste, neo-arsphenamin, and thromboplastin, while the latter consisted of horse serum, direct blood transfusion and deep roentgen-ray therapy. The patient became very weak, bleeding profusely from the gums, nose and intestines. On the fourth day at the hospital, he died from cerebral hemorrhage. On that day, oxydase stain showed granules indicating that the condition was finally one of acute myelogenous leukemia. This in a way is interesting because, during his first stay at the hospital, this test was negative.

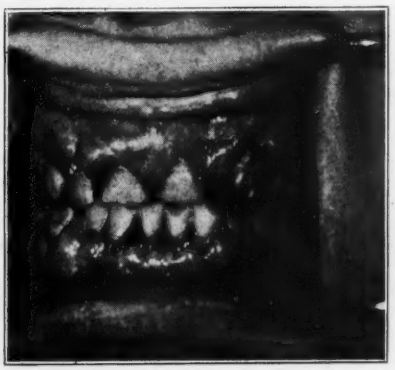

**Fig. 7 (Case 2).—Rapid recession of hypertrophied flap after intensive treatment for Vincent's infection; also proliferation of red subgingival inflammatory tissue, especially in the lower incisor and the upper right side areas. The papilla between the lower left lateral incisor and cuspid was used for the biopsy referred to in the text.**

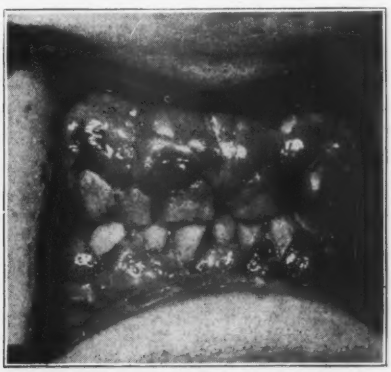

**Fig. 8 (Case 2).—The first crop of glistening red inflammatory pseudopapillae have now thickened greatly and have spread across the surfaces of the teeth. In the main, they have now turned anemic, like the original gum tissue, the same as those in Case 1, Figure 2. From underneath these, new rows of red inflammatory tissue were growing, each row pushing the preceding one away from the teeth. This succession of generations was extremely uncomfortable and even painful.**

I had no opportunity to observe the patient's gingival condition after his final admission to the hospital, but according

to Dr. Dulin, who followed the case very closely, the gums toward the end were "spongy and puffy" but not nearly so markedly as they were the first time.

COMMENT

1. The patient was first aware of the disease through gingival symptoms.

2. He sought the services of the dentist before consulting a physician.

3. The case illustrates the importance of a blood count at an early date in certain types of doubtful gingival conditions.

4. It emphasizes the importance to the periodontist of a knowledge of local differential diagnosis.

5. Should the combination of local symptoms, namely hypertrophy, pallor and persistent hemorrhage of the gingivae, which prompted the diagnosis of lymphatic leukemia in this case, prove through repetition to be pathognomonic of this disease, the dentist may be in a position to detect it at a comparatively early stage.

CASE 2.—Mrs. C., aged 36, housewife, was referred to me, November 14, 1925, with a history of bleeding gums covering the entire year previous to her visit. About three months before I saw her, the accidental death of a close relative had given her a severe shock and immediately, within twenty-four hours, her mouth became sore. The right retromolar area developed a gingival abscess, which soon opened, evacuating a great deal of pus. Several days later, the palatal gingiva opposite the upper left cuspid, which was covered by a gold shell crown, became sore and swollen. This was followed by gingival pain all over the mouth, accompanied by chills and rise in temperature. She then visited a dentist for the first time in many years. She was treated for Vincent's infection, but unsuccessfully.

When I saw the patient she had a generally anemic appearance. The gingivae were also pale with a bluish tinge (Figs. 4 and 5.) They were extremely hypertrophied and had some necrotic margins which were of hard consistency and not easily detachable. There was comparatively little hemorrhage but marked salivation and a very fetid odor. Gingival abscesses evacuated pus through fistulas labially to the lower right incisors and to the upper right bicuspids. The teeth, especially the anterior, were quite loose and very sore to pressure. The pulps of all the teeth were vital. Roentgenograms revealed marked alveolar destruction particularly around the anterior teeth. (Fig. 6.) Direct smears showed many spirochetes, with a few well formed fusiform bacilli. A culture showed *Staphilococcus albus* and a few tetragenous cocci. A blood count made at the clinic eight days earlier showed the following: hemoglobin, 70 per cent; erythrocytes, 3,950,000; leukocytes, 7,200; polymorphonuclear neutrophils, 71 per cent; small lymphocytes, 24 per cent; large lymphocytes, 5 per cent. The Wassermann test and urinalysis were both negative.

Treatment for Vincent's infection with neoarsphenamin and sodium perborate brought marked relief the first few days. The necrosis of the tissues disappeared and the hypertrophy was somewhat reduced. The pale hypertrophied gingival tissue, in the lower anterior region particularly, commenced to recede more rapidly, but, at the same time and with the same rapidity, brownish red inflammatory tissue began to sprout from between the gingiva and the teeth, especially interproximally. (Fig. 7.) Manipulation with instruments did not easily cause this tissue to bleed. Neither the alkaline antiseptic mouth washes now used nor the careful removal of calculary deposits had any apparent effect on its prolific growth, and it soon commenced to grow out from beneath the marginal gingiva all over the mouth. (Fig. 8.) Biopsy of a section of this tissue taken from between the lower left central and lateral incisors gave the following report: "The section shows squamous epithelium beneath which there is an edematous stroma densely infiltrated with round and polymorphonuclear cells and some plasma cells. There is no prominent hemorrhage and the inflammatory process is uniformly distributed through the connective tissue, to which it appears to be confined. Special stains for bacteria do not reveal their presence. There is no histologic evidence of malignancy. Diagnosis: Chronic inflamma-

tion." In addition, painful gingival abscesses began to form in various parts of the mouth. Evacuation of the pus from these brought relief. In spite of all local medication, as well as treatment by her physician, the patient's condition continued to become progressively worse. (Fig. 9.) December 13, the blood count showed the following picture, approaching that of pernicious anemia: hemoglobin, 50 per cent; color index, 1.2; erythrocytes, 2,000,000; leukocytes, 3,000; neutrophils, 40 per cent; lymphocytes, small, 53 per cent; lymphocytes, large, 5 per cent; mononuclears, 2 per cent; poikilocytosis and anisocytosis, slightly pronounced; hemoblasts, 3.

The patient was then placed in a hospital where the condition was diagnosed as "gingivitis due to focal infection in the nasal sinuses." She assumed a negative attitude, refused to cooperate and left the hospital several days after her admission. She died, May 11, 1926, of pernicious anemia.

730 Fifth Avenue.

# PREVENTIVE DENTISTRY FROM THE POINT OF VIEW OF THE PEDIATRICIAN*

By FREDERIC W. SCHLUTZ, M.D., Minneapolis, Minn.

THE almost complete indifference of the medical and dental professions to the problem of dentition and the hygienic care of children's teeth, until some fifteen years ago, is an amazing fact, as it stands out in contrast to the great present-day interest exhibited by both professions in this same subject. Difficulties of eruption and possible reflex phenomena resulting from them did give the medical man some concern. All manner of ills, from every conceivable gastro-intestinal disorder to epilepsy, were traced to this source as a cause. Eruption once accomplished, his interest in the tooth completely ceased.

The dentist showed the same utter indifference to the child's teeth and did not begin to take any interest until a tooth was presented for extraction or until a permanent tooth was brought for repair after advanced decay had occurred.

The shrug of the shoulder—the deprecating negative gesture of my dental colleagues of an earlier day—to my request for prophylaxis in a child with wholesale mouth infection and tooth decay is a memorable experience. Only when the request was changed to a command or even to a threat was relief obtained, and then service was given only half-heartedly and under grumbling protest.

The situation has undergone a remarkable change. Today, the dentist, the physician and the lay public are altogether alive to the problem of the development of sound tooth structure and growth from the beginning and to the possibilities of prevention of early tooth decay and oral infection. It is a recognized fact that the condition of the teeth, their appearance, the manner of their development, and any degree of premature decay, reflects much that is abnormal about the organism. On the

*From the Department of Pediatrics, University of Minnesota.

*Discussion of the papers of Drs. Schlutz and Adair will be found on page 2326.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 21, 1928.

contrary, orderly eruption, excellent calcification, proper formation, resistance to decay are equally fine indexes of normal behavior of the organism and of a good sound constitution.

Early dentition is interpreted by many as evidence of a strong inherited constitution. Irregular or delayed dentition is often the direct result of disease or of malnutrition. We have abundant clinical evidence that resistance and immunity are coincident with dense tooth structure. Furthermore, early dental caries in children, while it may be due to a transmitted disposition, is more often due to a lowered resistance of the organism.

Every evidence points to the fact that the teeth have a most sensitive and intimate relationship to the internal metabolism and to the constitutional make-up of the individual. There are, indeed, few general abnormalities in the child's organism which are not, to some extent, reflected in the tooth structure. The teeth of the syphilitic, the tuberculous or the mentally defective child or of the child with some ductless gland dysfunction are striking illustrations.

One may conclude that normal dentition is fundamentally the result of sound cell-structure in the germ plasm. Conversely, abnormal or pathologic dentition is often due to hereditary defect in this same germ plasm.

Incipient caries of children's teeth may be present even at the beginning of dentition. Kassowitz, German pediatrician, observed it in nearly 90 per cent of his clinical material. It is estimated that dental caries is found in about 95 per cent of the school children of North America, England, Germany and Switzerland, and, in some instances and localities, reaches 100 per cent.

Many acute and chronic diseases profoundly affect the teeth. Both tooth-structure and general development are influenced. These effects are noticed during the active course of the disease or during convalescence and may be carried far into the later period of childhood. Among the disorders which entail these results, all those which profoundly affect nutrition stand foremost. In this category are included practically all acute and chronic diseases of the gastro-intestinal tract and especially the so-called deficiency diseases, such as scurvy, rickets, pellagra, and beri-beri. In the latter group of conditions, there is an almost specific effect on the teeth.

Such acute contagious diseases as scarlet fever, measles and diphtheria sometimes markedly alter the metabolism of the teeth. All chronic disorders resulting from low-grade systemic infections, and especially those which lead to serious debility and particularly to malnutrition, are prejudicial to dentition. Such results are seen in various forms of chronic arthritis, in chronic pulmonary conditions, such as bronchiectasis, and in chronic cardiac conditions consequent on infection.

The influence of any disease, acute or chronic, on tooth structure and development is characterized by two things: the subtlety of the onset and the persistence of the effect. These are acquired conditions and may be superimposed on a tooth structure originally and entirely sound.

The condition is quite different as regards the teeth of infants and children suffering from congenital defects or constitutional anomalies. These subjects almost invariably and from the very outset of dentition show defective tooth structure or formation, abnormal tendency to decay and great irregularity

in the eruption of both deciduous and permanent teeth.

It is characteristic of all mentally defective children and of those affected with congenital organic brain or nerve disease that they have poorly calcified, glassy, transparent teeth which are easily worn down, show early decay, and indicate in every way the low resistance of these particular structures. The same thing is true of children affected with such congenital blood degeneration and dyscrasia as hemophilia, purpura hemorrhagica, leukemia or aplastic anemia.

The teeth of infants affected with congenital rickets or rickets of an extreme type, i. e., osteomalacia, are not alone defective in the structure and content of the chemical elements, but are also extremely abnormal as to the time of eruption of the teeth.

All children suffering from distinctive ductless gland disorders have peculiar and defective teeth. The cretin or the child showing hypothyroidism has very large flat teeth, widely spaced and showing marked delay in eruption. There is a tendency to early decay and poor calcification. All three characteristics are emphasized if the condition goes untreated. The mongolian idiot has sound tooth structure with good calcification, but shows extremely irregular eruption with abnormally shaped teeth and a marked tendency to malocclusion.

Cases of hypoparathyroidism or hypopituitarism show irregular eruption of teeth, poor calcification and a marked tendency to early caries. Similar conditions are observed with dysfunction or aplasia of the sexual glands and structures, notably the gonads. Certain of the constitutional diatheses, for example, in infants of the lymphatic type, affected with tetany, show defective calcification and the tendency to early decay. This is particularly the case if the children are of the order formerly known as the scrofulous type, with tuberculous tendencies. The thick, pudgy, plethoric type of child is more liable to defective tooth structure than the thin, asthenic type, on account of his lesser concentration of tissue and of minerals.

The effect of the two widely spread constitutional diseases, syphilis and tuberculosis, on tooth structure and development is a familiar picture to every medical practitioner and dentist. In the syphilitic child, there is the peculiar shape of the teeth, such as the peg, the Fournier and Hutchinson's teeth, along with a marked tendency to early decay; in the tuberculous, there are the linear defects and serration, showing poor calcification, and also a predisposition to early decay. The tooth structure is practically never sound in the organism affected with either of these two widely spread diseases, either in congenital or in acquired form.

The recognition of this interrelationship between the causes and the effects of pathologic change, in their influence on structural and functional health, especially in early life, when change in the human organism is most readily induced and most readily adjusted, has had its effect on the public health as well as on the medical practice of the day. It has given birth to the conception of disease as a thing to be prevented, of health as a thing to be preserved and promoted. It has transferred our primary objective from the sick to the well. It has introduced into our methods of service the periodic health examination as the mechanism by which hygienic influences, in their effect on growth and development, may be best encouraged; the interaction of general health and specific phases of health may be intelli-

gently studied; departures from the normal may be most readily observed; health habits may be cultivated and health behavior corrected; initial tendencies to disease may be watched or averted, and early cure or arrest of disabilities may be accomplished.

The dentist has caught the suggestion of this protective practice and is today encouraging his patients, as he should, to the acceptance of periodic examinations of the teeth as the best means to their favorable evolution, to their preventive treatment, to the counteraction of either local or general causes of disturbance, perversion or decay. The promotion of periodic health examinations is one of the most economic movements of the age.

In view of the intimate relationship and the sensitive reactions of the teeth to the internal metabolism of the living animal organism, it is of interest to recall some of the details of their origin, structure and chemical composition. Embryologically, they are derived from the ectodermal and mesodermal layers. The enamel, the densest tissue of the body, arises from the ectoderm, and the dentin and pulp, from the mesoderm. The cementum is true bone.

The essential parts of the tooth are peculiar and distinctly different from bone, the tissue they most resemble. The principal difference between teeth and bone is in the water content. All component parts of the tooth contain less. The element magnesium is more prominent in teeth than in bone, and the element flourin, quite rare in other structures of the body, is present in definite quantities in the enamel and dentin. There is comparatively little organic material in the tooth. The peculiar gelatinous protein substance, collagen, forms part of it. Nasmyth's membrane, covering the outer surface of enamel, is a protective covering, organic in character and found only in teeth. The element calcium, in the form of either the carbonate or phosphate, makes up the principal part of the inorganic tooth structure. More than 94 per cent of the enamel and more than 67 per cent of the dentin is composed of these salts. Both calcium and phosphorus are sovereign elements in the make-up of tooth structure.

The normal sound tooth is a dense biologic mass of stable structure. There are no blood vessels in the tooth and only a minimum of cellular elements. This means that the tooth lacks the dynamic character of cell structure and grows or develops largely by the process of deposition. As a result, its structure has little chemical activity. Its very passivity of biochemical function makes the tooth relatively defenseless and limits its powers of self-repair or regeneration. It cannot easily remove decomponents from its structure or repair breaks in the continuity of its protective enamel coating.

For certain of these reasons, it is probably essentially difficult to improve adult normal tooth structure by nutritional or other physiologic processes. This is not so difficult in the teeth of the infant and the young growing child.

It is now known, as a result of extensive research, that calcium and phosphorus are among the most important elements necessary for the proper functioning of the animal organism. They are both present in fixed form in all the structural parts of the body and in free mobile form as components of the fluids circulating in and about the fixed tissue. They are most intimately connected with and influence the most diverse of physiologic functions. Marked changes

in their equilibrium are promptly reflected in abnormal reactions or symptoms. Any marked loss of these elements from the fluids of the organism is replaced, at least in part, by their subtraction from the fixed sources of supply. The teeth, among other tissues, are doubtless so directly affected.

It is known that certain of the endocrine glands have a definite regulatory effect on the calcium and phosphorus metabolism of the body and probably influence, in many ways, the mineral deposits of the body.

Since calcium and phosphorus enter so largely into tooth structure, and since the hardness and soundness of the tooth are directly dependent on their adequate presence, it may be readily seen that any factor in the internal metabolism of the organism which unfavorably influences the equilibrium or balance of these elements will be quite promptly reflected on the tooth structure and will jeopardize its soundness and ability to resist unfavorable influences in its environment.

Disturbance of this mineral balance is doubtless one of the most potent causes of the predisposition to early tooth decay and destruction.

Experimental work, of unquestionable accuracy, has established the fact that, for satisfactory bone-formation, at least four factors must be adequately and effectively provided: calcium, phosphorus, calcifying vitamins and radiant energy. These are also the essential factors in good tooth structure. Its stability, its resistance or susceptibility to bacterial invasion during either its developmental or its mature stage depend largely on these biochemical and physiochemical conditions.

It is furthermore an interesting clinical fact that practically all the diseases which are strikingly causative of the break-down of the teeth, as, for instance, rickets, osteomalacia and tetany, uniformly show marked disturbance in either the calcium and phosphorus metabolism, or in both.

There is increasing and abundant experimental proof that the most intimate relationship and interdependence exists between endocrine function and the biochemistry of these two elements. It is quite clear, in fact, that calcium and phosphorus are of importance above all other elements in the establishment and maintenance of sound tooth structure. It is their fundamental metabolism which must have much greater concern than the behavior of the tooth itself or the conditions of its immediate environment. It is of much more consequence to detect any abnormal metabolism of these two elements and the causes underlying it than to worry about the bacterial flora of the mouth and the acidity or alkalinity of the secretions bathing the tooth and the gum.

The dental profession, I believe, attaches great importance to the local conditions of the mouth. A great deal of tooth and gum disease is attributed to acid states of the mouth secretions and to bacterial influences operating more actively in such a medium or actually creating it. I am not in a position, and surely not sufficiently qualified, to pass on the merits of such opinions. I wish, however, to call your attention to the fact that the medical profession is today attaching great importance to the study of acid-base equilibrium in the body and is of the opinion that they are of fundamental importance in the establishment of normal or abnormal metabolic functions. This acid-base equilibrium, in which again the mineral elements of the animal organism play the important

rôle, is apparently as sensitive as a barometer to every conceivable influence. I lack as yet experimental proof in support of my contention, but I would advance the thought and the opinion that the maintenance of the proper acid-base equilibrium of the animal organism is as essential to sound tooth-structure and development as it is to all other proper metabolic functions in the body, which, in the final analysis, are the essential requirements for keeping us in a state of good health. The maintenance of this important equilibrium or metabolic balance directly influences another great function of the organism, the production and maintenance of antibodies and immune substances adequate to combat the constant threat of aggressive bacterial invasion.

There has been some speculation regarding the possibility of influencing tooth development and tooth structure in fetal or intrauterine life. It is known that the expectant mother supplies the major part of the required mineral matter for the fetal organism during the last few months of pregnancy.

It has been shown experimentally that radiant energy and a proper dietary, particularly with regard to its mineral and vitamin content, can and does influence the expectant mother in the direction of favorable mineral balances. It is conceivable that these effects may be so far-reaching as to affect the development of the dental structures of the fetus and influence their characteristics in later life. Much experimental work needs to be done in this field before one can come to definite conclusions.

It must be clear from the foregoing brief and altogether inadequate and incomplete sketch of some of the dental problems of infancy and childhood that the pediatrician must, indeed, have an interest in preventive dentistry and may, and, in this modern day, must play a major rôle in its achievement. There is no period of childhood, from early infancy up to puberty and beyond, when preventive dentistry does not, in some way or other, come within the scope of his interest. There is the period of early infancy, with its problem of orderly, regular and timely eruption of deciduous teeth. The occurrence of reflex irritation resulting from abnormal eruption, formerly so seriously regarded and overemphasized by the medical practitioner of a passing age, is now almost entirely disregarded, or at least minimized, by the medical profession. Seldom, indeed, is any acute illness now charged to teething; seldom does the practitioner or his dental colleague resort to the lance to hasten or facilitate by surgical procedure the eruption of the teeth.

The achievements of the orthodonist have taught the pediatrician and the general medical practitioner the possibilities of reconstruction of the mouth or of the dental arches, the adjustment of disfiguring malocclusion, of the protrusion or the recession of the teeth, with all the beneficial and far-reaching consequences which may follow intelligent treatment. Actually, the entire facial outline and physiognomy may be changed by the deft and judicious procedures of this specialty of child dentistry.

The excellent work in this dental specialty has only one drawback, in that, for various reasons, probably largely economic, it is not available to the public at large. This is a defect to the correction of which the dental profession should direct its earnest attention.

The pediatrician is interested at all

times and in all ages of childhood in dental caries and the oral infections which result from such tooth decay. It is quite true that the problem of focal infection from defective, diseased or abscessed teeth does not have the significance in childhood that it has for the adult. Nevertheless, it is a serious possibility in the older child after the eruption of the permanent teeth. In the effective practice of this type of oral hygiene lies one of the great advances of modern child dentistry. It is the very thing that it was so difficult to persuade the dental colleague of a decade or so ago to carry out.

No medical practitioner or dentist of today will question the value of early repair of dental caries in the child. To them, both the evidence of such early decay and that of defective tooth structure should have greater significance than the mere fact that only the tooth structure seems involved. Even a cursory inventory of the child's organism as a whole will reveal the deeper significance of this destruction. On investigation, one quickly encounters evidence of constitutional disease, of grave disturbance from most diverse causes, in the mineral balance, the acid-base reaction or many another phase of the internal metabolism.

Patient inquiry, careful systematic and intelligent examination, will commonly reveal the underlying cause of the disordered nutrition which reflects itself in the oral condition and points out the way to proper relief. This may be the timely use of a proper diet, with regard to vitamin, mineral and protein content. It may be the effective use of radiant energy in the form of solar or electric arc-light irradiation. It may take the form of ductless gland therapy, or the judicious use of such medicinal agents as cod liver oil or the newer products of irradiated cholesterol; all these things bearing on the important demand of the animal organism for the positive balance of such important elements as calcium and phosphorus.

These fields are, of course, the special province of the pediatrician, but is it not now clear how thoroughly they command his interest in the field of preventive dentisry and suggest him as the most useful collaborator of his dental colleague? On the other hand, the dentist is necessarily limited in this field alike in training and experience, and must look to this medical colleague for help.

There has been a most extraordinary development of mechanical agencies for relief and reparation in dental practice; and one must recall with admiration the splendidly useful and disinterested propaganda of the dental profession for oral hygiene. One may well wish that these efforts might be matched by similar progress in the prevention of dental and oral abnormalities. Dentistry is triumphant today in the art of mechanical repair, but it is still baffled before the mystery of the factors which lie beneath the dental disorder and which, duly understood, would prevent its occurrence.

The problem and the range of service in preventive child dentistry are quite clearly defined for the two professions and are in every way complementary. The one group cannot well dispense with the services of the other.

We know that a tooth, perfectly formed and kept fully intact by natural or artificial means, may remain healthy and in function for a lifetime under ordinary conditions of use and even regardless of oral hygiene. The fact rather confirms the opinion, now gen-

erally held, that the secret of the prevention of dental abnormality really lies hidden in the constructive processes of normal dentition rather than in the conditions of superficial oral hygiene, important as the latter doubtless is in removing extrinsic hostile agents or in neutralizing dentally destructive influences.

The physician must discover, clear up or remove for his dental colleague the deep, underlying, mysterious conditions, constitutional, metabolic, or otherwise, which result in dental abnormality. To him should be left the dietetic supervision and general hygiene of the case. All such remarkably effective agencies as radiant energy or suitable medication, aimed at the preservation of favorable mineral balances and at the correction of an abnormal metabolism, must be judiciously employed by him or be under his supervision and direction. It is unfortunately true that the medical profession is still altogether too indifferent to its obligations and opportunities in this field.

The dentist must reciprocate the efforts of the physician with his extraordinary and consummate skill in reconstructive and repair work. Structural oral deformities must be corrected at the earliest possible age. Since the tooth cannot, within itself, remove the products of decay, or repair its defects in structure or mend breaks in the continuity of its protective covering, and since it is quite defenseless against invasion by micro-organisms, it is clear that skillful dental repair of the carious tooth is indicated at all ages of childhood and alike in the deciduous and in the permanent set.

In view of the present day conception of focal infection as a possible causative factor in the production of disease, its removal as completely and quickly as possible is unqualifiedly demanded of his dental colleague by the medical practitioner. There is no longer any difference of opinion between the two professions regarding this important phase of preventive dentistry and oral hygiene.

It is obvious to everyone how dependent on each other the medical and the dental professions are in the field of the preventive dentistry of children. They meet on common ground and with common interests. Only by a combination of effort can their problems be solved and preventive child dentistry become the really useful agency for the public welfare it promises to be today.

# PRENATAL CARE AND DIET*

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THERE seems to be no longer any doubt that prenatal care is recognized as an essential part of the attention which should be given to the expectant mother. That the giving of such care is not so general as it should be cannot be disputed. There are many important parts to this supervision, of which that of regulating the diet is very important, especially in some cases. Many persons eat a rational and fairly well balanced diet; at least, theirs is in no sense a deficiency diet.

It may be well to understand that there is no specialized diet for the pregnant woman, even though it is of greater importance for her to adhere closely to the principles of proper nutrition. It is well for us to keep in mind that we are dealing with processes which do not necessarily go hand in hand. There is the ingestion of food, the digestion of food and its assimilation into the bodily economy, and we must not forget that the ingestion and even the digestion of food does not necessarily mean that these products enter into the physiologic processes of the organism.

In the case of the pregnant woman, the matter is further complicated by the fact that we are dealing with even a more complex problem because one organism is living within another and dependent on it for the proper carrying out of its own more or less independent processes. Granting that the prospective mother receives an abundance of all the necessary organic and inorganic substances, as well as the vitamins, what happens to her and to the fetus?

The situation then is somewhat as follows: If her digestive tract functions properly, these foods are digested, absorbed and assimilated in the amounts necessary to maintain life and function and perhaps provide for storage, as indicated by an increased weight. The oversupply, if present, is broken down or not assimilated. It should be borne in mind that any excess, in all probability, does not alter in any material manner the cellular or humoral composition of mother or fetus, which must be more or less constant with certain physiologic variations for storage of fat and glycogen. It is evident that the fetus has no other source of growth and energy than the parent from whose tissues and fluids it must derive the ingredients necessary for its own life and development. The rapidly growing fetus with embryonal cells, tissues and fluids undoubtedly does not have the same proportional composition of elements as the more mature and stable parent.

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It is generally known that there is no direct vascular, nervous or other pathway between mother and offspring. There is a definite living barrier interposed between the two through which every substance going from mother to fetus and vice versa must pass. Nor can this placenta be regarded as a mere filter, or even as an osmotic membrane. It is more; for it takes on the function of an organ and most certainly exercises a selective action, if nothing more, on substances which pass through it; and, in a sense, it acts for the fetus as a digestive, a respiratory and an excretory tract. As Feldman[1] writes, apropos of the Psalmist's description of the heathen idols, " 'It has eyes but it sees not; it has ears but it hears not;' and it may be added, it has a mouth but it eats not, and lungs but it breathes not. Its kidneys and bowels, too, are in a dormant state, and all its various functions of nutrition, respiration and excretion are carried out for it by its mother."

Assuming, then, that the maternal organism is receiving an adequate supply and is functioning normally, it is apparent that the placenta and fetus may still fail in the proper performance of their duties. The incapacity of the placenta is so marked at times that the developing fetus outgrows the functional ability of the placenta, and a small, immature, poorly nourished infant is born. In other cases, the placental insufficiency is so marked that the fetus dies *in utero*. Presumably, the placenta may fail in lesser capacities as well; which would have a definite effect on the nutrition and metabolism of the fetus. Of these functions, we know very little. The placenta may at times be permeable to bacteria, their toxins and other deleterious substances; which may lead to disease and death of the fetus. We will not go further into this subject as it is not pertinent to the present discussion.

It is quite possible for the prospective mother to receive an adequate supply of various necessary food substances which she is unable to utilize properly for her own good. In some of these cases, it is possible to stimulate her metabolic processes. In many cases, the pregnancy itself seems to act as such a stimulus; but in some cases, the reverse is true. When she is unable to metabolize the necessary foodstuffs, the result is, for her, about the same as if she were receiving an inadequate amount. In instances of this kind, what happens to the fetus? There is much to indicate that it suffers less than the mother, for, being more or less parasitic, it takes what it needs even though this is detrimental to the maternal host. It would be only in extreme cases of maternal starvation or marked deficiency in diet that the fetus would suffer material damage. If the opposite were true, and the maternal organism assimilated an excess of foodstuffs, it is extremely doubtful that materials could be forced through the placenta in excess of the actual demands and needs of the growing fetus.

The point which we are trying to stress is quite obvious, namely, that prenatal diet should be regulated mainly from the point of view of its effect on the mother, and not with the more problematical and theoretical idea of the effect on the fetus. This is, of course, a general statement and one which needs much more study, but it seems justified in our present light.

When it comes to the problem of influencing oral conditions in the fetus by

1. Feldman, W. M.: Principles of Ante-Natal and Post-Natal Child Hygiene, London: John Bale, Sons & Danielsson, 1927, p. 251.

the maternal diet, we are walking in a much smaller field, and it is extremely doubtful whether or not we should allow this to influence us materially in selecting a diet for the prospective mother. Fortunately, there is seldom any conflict between what is good for the mother and what for the fetus, as their food requirements are qualitatively pretty much the same.

One whose primary medical interest lies in prospective mothers and their offspring is inclined to view this problem of the relationship of diet and nutrition to oral health from several points of view. Our greatest interest is, of course, in the preservation of the lives of mother and offspring. The question next in importance is the maintenance of their health; and lastly comes the preservation of various portions of their bodies from injurious influence.

We are then definitely interested in carrying out any regime which will maintain oral health, if such a procedure does not interfere in any way with the life or general health of either mother or offspring, provided such a contingency could and might arise. We could say that we are interested in the effect of diet and nutrition on the oral conditions of the mother herself.

Our desire is to create a situation, by proper diet of the mother, which will insure to the offspring the best development during its intra-uterine life and also during its early extra-uterine life, when it is dependent to a great extent on its mother's milk for the proper and best food and nutriment. This should be accomplished for the infant with the least possible detriment to the mother. The problem then concerns the mother during two particular phases of her existence, first, the period of gestation, and second, that of lactation.

As far as the offspring is concerned, our interest centers on the cycle of its intra-uterine life and that portion of its early extra-uterine life when it is dependent on its mother for food. During all this physiologic period, we are not and cannot be concerned primarily with one individual, since the health and lives of mother and offspring are more or less interdependent, and we should be careful not to harm one to benefit the other, if such a misfortune can be avoided.

It has been stated by Hartzell[2] that foods for the mother in the prenatal period carrying a maximum of those substances necessary to the structure of the body are of incalculable value, and their absence leads to the gestation of young that are distinctly defective, not only in body structure, but in physical resistance as well. That such deprivation during the period of gestation may be in a measure compensated for in the postnatal period by beginning the administration of properly balanced rations at the earliest possible period seems to be true and worthy of our greatest consideration.

I am not in entire accord with these conclusions regarding the effect of diet on the offspring. I am of the opinion that the mother is more likely to be injured by improper diet during gestation than is her offspring unless this diet is pushed practically to the point where the mother suffers from starvation, and even then the parent would receive the greater injury.

Reverting more particularly to the subject of oral conditions, we believe that the teeth may be regarded as essentially skeletal structures. From experimental work and observations, it has been found that the development and maintenance of dentition have practically the same requirements as those for proper skeletal development and maintenance. This, of course, does not apply

2. Hartzell, T. B.: Ten Years to Life, J.A.D.A., 9:831 (Oct.) 1922.

to other oral conditions, such as may affect the gums and soft tissues.

Jackson[3] states that the teeth, while susceptible to rickets and scurvy, are very resistant to inanition, both partial and complete. In total inanition or on water alone, the teeth of adults show no appreciable change in weight or structure; but, in chronic incomplete inanition, there are slight changes in chemical composition. Aside from observations in connection with rickets, not much is known as to the effects of dietary mineral deficiencies on the structure of the teeth. Whatever changes take place in the teeth would have their counterpart in the bones. It is apparently much easier to produce an effect on developing and growing bones and teeth than it is on those which have matured. It would appear that it requires a much more pronounced deficiency in diet to affect a mature than an immature individual. One would hardly expect to be able to produce rickets in an individual who had attained full development. On the other hand, it seems difficult to find rickets in the new born. Kassowitz[4] maintains that rickets may be congenital. Park[5] believes that it is rarely congenital and present at birth, and never in a pronounced form. Pathologists have been unable to find positive evidence of it in the new born. Von Reuss[6] thinks the question of intra-uterine rickets remains undecided.

It seems to be true, then, that a deficiency in calcium metabolism is probably injurious to adults, and this would be especially true of the pregnant woman because of the demands of the fetus. It is problematic whether or not the fetus suffers much from a calcium deficiency in the diet of the mother.

Julius Misch,[7] in describing the relationship between oral conditions and pregnancy, states that the injurious influences of pregnancy and lactation on the teeth are well known. He says that the following conditions come under consideration as causes: "(1) metabolic influences; (2) changes in the salivary secretion; (3) oral diseases." He considers the metabolism of pregnancy as of very first importance, and notes the physiology of metabolism of pregnant women and also the pathologic conditions which were found.

The metabolism of phosphorus is of great importance. As a rule, nitrogen and phosphorus balance run parallel. About 16 per cent of the amount ingested is retained. If enough protein is ingested, sufficient phosphorus will be retained. A fetus and placenta at term contain about 80 gm. of nitrogen and 45 gm. of phosphorus. The relationship between nitrogen and phosphorus is about four to one.

The calcium metabolism is even more important than that of phosphorus during pregnancy. During the latter half of pregnancy, the need of the fetus for calcium is very great. Soeldner found in a new-born weighing 2,821 gm. a content of calcium oxide of 26.8 gm. Dibbell estimates that the fetus in the last five months of pregnancy needs 0.17 gm. of calcium oxide per day. Most protein substances have a small calcium content. Authorities differ as to the amount of calcium needed by the nonpregnant woman. The amount of calcium oxide necessary varies from 0.5 gm. to 1.5 gm. per day.

It has been experimentally shown that

3. Jackson, C. M.: Effects of Inanition and Malnutrition upon Growth and Structure, Philadelphia: P. Blakiston & Sons, 1924, pp. 156-161.

4. Kassowitz: Quoted by E. A. Park, Dent. Cosmos, 65: 176-185 (Feb.) 1923.

5. Park, E. A.: Footnote 4.

6. Von Reuss, A. R.: Diseases of the Newborn, New York: William Wood & Co., 1922, p. 377.

7. Misch, Julius: Lehrbuch der Grenzgebiete der Medizin und Zahnheilkunde, Leipzig; F. C. W. Vogel, 1922, Vol. 2, p. 171.

pregnant animals may suffer from decalcification when they are placed on a low calcium diet. In a calcium-poor diet, it is not the fetus, but the mother who suffers. It is also possible that even with a calcium-rich diet the mother may suffer from calcium loss. Apparently, from the investigations of Lammers, there is an increase of the calcium content in the blood during pregnancy; an average of 10.8 mg. of calcium oxide to 100 cc. of blood in nonpregnant women and 11.7 in pregnant women.

A study of calcium metabolism during pregnancy is more complicated because of the alterations in the endocrine system which influence the calcium balance.

The fetus takes what it needs for its nourishment without regard to the mother. It may be regarded as of a parasitic character.

While the nitrogenous and phosphorus bearing substances go hand in hand, this is not true of the calcium bearing foods. During pregnancy, it is especially important not to increase the meats, but to give more vegetable foods, coarse bread and milk.

This calcium excretion also continues during lactation. There is a great variation in the amount of calcium found in the mother's milk, according to different observers. It is not dependent upon the calcium intake of the mother, and is not easily influenced by the ingestion of calcium.

The daily need of the fetus during the latter months of gestation for calcium is about 0.17 gm., which corresponds to about 1 per cent of its body weight. During the period of lactation, of nine months, the child requires about 50 gm. of calcium oxide, which is equivalent to about 0.18 gm. per day. Actually, the fetus and child need more because a certain amount of calcium is excreted. It is advisable, therefore, to increase the calcium ingestion during pregnancy and lactation so that the mother may not suffer from calcium deficiency. There is this difference between gestation and lactation. Apparently during gestation, the offspring takes what it needs irrespective of the welfare of the mother. During lactation, if the mother is on a calcium-poor diet, she secretes less in the milk, at the expense of the child. Briefly, the situation is as follows: During lactation, the calcium supply to the child is greater than during pregnancy. During gestation, a calcium poor diet is more detrimental to the mother than to the fetus. During lactation, the situation is reversed. A diet deficient in calcium is more detrimental to the nursling than to the mother.

It has been thought that it was possible to control the size and development of the fetus by the mother's diet, and this theory has been applied in practice. It is, I believe, fairly well established now that this is true only to a very limited degree; that the fetus is to be regarded as a parasite and that its needs are met by its own demands rather than by the maternal supply. Prochownick,[8] who was the originator of the diet not uncommonly prescribed for mothers, claimed actually that infants born of mothers kept on this diet showed all the signs of normal maturity, being an average length and having a normal skeleton, with all bones of normal hardness, and head dimensions normal. Fat tissue alone seems to be deficient.

Ehrenfest[9] states:

> The assumption of the defenders of this diet, that fetal development could be noticeably influenced or actually retarded by food restriction, is incompatible with present biologic knowledge. The fertilized ovum is not a maternal body cell, necessarily subject to maternal metabolism, but an individual organism. The placenta is not merely a passive mechanic filter but an organ endowed with an active vitalistic function, which promptly and reliably supplies the fetus with all the substances essential for its development, as long as they are available to the maternal organism. The evident beneficial influence of certain economic factors on the average of birthweight is grossly misinterpreted if considered solely from the standpoint of the better nutritional condition of the mother.

If it were possible to influence the fetal calcium metabolism materially by the diet of the mother, one would have

8. Prochownick, L.: Zentralbl. r. Gynäkol., 33: 577, 1889.

9. Ehrenfest, H.: Am. J. Obst. & Gynec., 80: 441 (Oct.) 1919.

to be extremely careful because, while calcium deficiency would constitute a serious problem of defective development in the fetus, overcalcification would present a serious obstetric situation arising from the increased skeletal development and hardness of the head, which would complicate the mechanism of labor.

The measures necessary to insure the mother, and perhaps the fetus, a proper calcium metabolism are simple and harmless. All that is necessary is to have a diet well supplied with inorganic salts, which are easily obtainable in foods such as milk and leafy vegetables. Then, there should be plenty of the fat soluble vitamin A, and such stimulators of metabolism as sunshine and fresh air. The administration of cod-liver oil as a routine has disadvantages and is not often necessary in the pregnant woman.

Other inorganic salts are widely distributed in foods, and with the one exception of iron, they do not require much special attention. There is a tendency toward the development of anemia in many pregnant women, which is doubtless due to the insistent demand of the fetus for iron which it utilizes for growth and storage.

Slemons[10] makes the following statement regarding the interchange of the inorganic salts:

> With regard to iron, it is impossible, at present, to affirm what arrangements are made for its transportation through the placenta. This intricate and unsolved problem occupies a unique position among the factors of fetal nutrition. Stored in the newly born infant, there is a large quantity of iron, so large, indeed, that the quantity is proportionately much greater than in the adult. The purpose of this storage in the new-born, Bunge believes, is to compensate for the inadequate amount of iron in human milk.

10. Slemons, J. M.: Nutrition of the Fetus, Yale University Press, 1919, p. 41.

Feldman[11] states:

> The iron is derived in part from maternal hemoglobin. Peters found evidence of the presence of red blood corpuscles in the trophoblast of the early human ovum. Other possible sources are nucleoprotein and the reserve iron of the mother. Charrin found that during pregnancy there is a gradual diminution of iron in the mother's spleen. The iron in the fetus is stored in the liver, but also in other fetal organs. It diminishes rapidly after birth, and Bunge believes that this reserve of iron compensates for the deficiency of iron in the milk.

It is wise, therefore, for the mother to receive plenty of iron-bearing foods in her diet, and she may require special medication if she shows much anemia.

One has to consider the possibility of the development of scurvy in the mother, and, occasionally, we find scorbutic-like gums, especially in the early months of pregnancy, when the prospective mother may be on a deficiency diet, because of the nausea and vomiting not uncommonly associated with pregnancy.

Jackson [3] writes:

> In scurvy, the gums are markedly congested and swollen in about 80 per cent of the adult human cases, but apparently in a much smaller proportion of guinea-pigs. The alveolar bone and peridental membrane undergo necrosis, with consequent loosening of the teeth, and ulcerations or pyorrhea may occur. Congestion and hemorrhage appear very early in the dental pulp, with consequent pulpal degeneration and fibrosis, and possibly osteodentine formation. Scorbutic changes may affect the teeth before eruption, even in the fetus. Recovery of normal structure in the teeth is possible upon antiscorbutic diet, unless extreme degeneration has occurred.

It is this early period of pregnancy which makes us the most trouble from the standpoint of diet, and here we are not infrequently confronted with the problem of combating toxemia and pre-

11. Feldman, W. M.: Principles of Ante-Natal & Post-Natal Child Physiology, New York: Longmans, Green & Co., 1920, p. 136.

venting dehydration and starvation. Brown and Depree[12] state that:

> The study of embryology demonstrates that the thickening of the epithelium, which is the first sign of the process of the development of the future teeth, begins at about the sixth week of fetal life, and the dental lamina is completed by about the end of the seventh week; in other words, the probable state of your teeth, if any, when you reach the age of 70, assuming that you haven't succumbed to some form of malignant disease before attaining that age, must depend, to a very large extent, upon the diet consumed by your mother when you had existed for six weeks *in utero*. All efforts in the direction of preventive dentistry which ignore the developmental, in other words the *dietetic*, factor, and especially the *antenatal dietetic* factor, are obviously doomed to failure.

If correct, this would be very unfortunate and important, as it is during the first three months of pregnancy that the greatest nutritional problem is presented because of the rather frequent and often persistent loss of appetite associated with nausea and vomiting.

We have not only the problem of undernutrition and deficiency diet confronting us during pregnancy, but also that of overfeeding and excessive weight gain. Here again, we are not so much concerned about the overgrowth of the fetus as we are over the increased weight, which is not a good thing for the mother and may sometimes complicate labor. Fortunately, some of the food substances which tend to increase weight can be dispensed with without harm to the mother or the possibility of damage to the fetus. These are the carbohydrates, which are not essential, except in limited amounts. Obesity in pregnancy is a condition which requires attention, though it is not associated particularly with oral conditions; but sometimes it is necessary to avoid advising too liberal a diet. Then, too, we have to consider certain special diets, which may be indicated in certain pathologic states, as, constipation, diabetes and toxemia.

In general, we probably do not give sufficiently detailed advice to our patients regarding their diet, and, on the other hand, in certain states, we emphasize the elimination of some of the articles the detrimental effect of which may be far from being established. The diet should contain protein, fats and a moderate amount of carbohydrates, with sufficient cellulose and plenty of the inorganic salts, especially calcium, iron and phosphorus. Vitamins are of definite importance, but are widely spread in fresh foods. The vitamins A and C are of especial importance in connection with oral conditions.

It seems to be true, then, that we can expect little, if any, detrimental influence on the development of the fetal oral structures through the maternal diet during pregnancy unless such diet is practically pushed to a starvation limit, or is definitely deficient. This is because the mother has stored in her tissues sufficient material for the development of the fetus should this developing organism require it. It is equally true that a deficient diet may prove very deleterious to pregnant women, and this applies to oral conditions as well as general physical conditions.

In the ordinary case of pregnancy, the critical period as far as the mother is concerned, is the first trimester, when there are so many digestive disturbances associated with nausea and vomiting, malaise and loss of energy, resulting in loss of weight and more or less physical deterioration. As far as oral conditions are concerned, we not infrequently see gingivitis, beginning caries and salivation, especially in the group of cases in which nausea and vomiting are marked.

12. Brown, J., and Depree, S. B.: Practitioner, 110: 448-453 (June) 1923.

After this period of three or four months, there is usually a stimulation of metabolism, with improved appetite and general physical up-building, with rather rapid gain in weight and all around general improvement.

After the birth of the child, the maternal organism will apparently not give up material essential to its well-being for the benefit of the offspring. Probably, the composition of the human milk depends on the excess of food material in the maternal organism, and is not taken from this organism to its own detriment. It is quite obvious that, unless the mother is supplied with sufficient food during the period of lactation, the infant is the one to suffer the greater injury. The situation is apparently the exact reverse of that which exists during the period of intra-uterine life. In brief, during intra-uterine fetal life, the fetus will, if necessary, develop and grow at the expense of its mother; but during extra-uterine life, the maternal organism will protect itself at the expense of the offspring. It is therefore important that we strive particularly to protect the maternal organism by proper diet during pregnancy and the offspring by proper maternal diet during lactation.

Bar[13] comes to the following conclusions:

1. In a healthy mother, living under normal conditions and receiving a sufficient diet, pregnancy with a healthy fetus is not a "period of self-sacrifice."

2. The association between mother and fetus may best be described as one of "harmonious symbiosis," in which the mother often derives benefit from the fetus.

3. The modifications in the maternal nutrition, brought about by the presence of the fetus, are manifestations of a special physiological state in which the maternal organism adapts itself, without injury to itself, to the requirements of the fetus.

4. These happy conditions are only realized when there is a *fetus sanus in matre sana.* When this condition does not prevail, or when the mother's diet is not satisfactory, this special metabolism is disturbed, with disastrous results to the mother as well ten derives benefit from the fetus.

In the sixteenth century, the following advice was given to the prospective mother in "Paedotrophia":

. . . . be careful, how your Meats you chuse,
And chosen well, with Moderation use.
With too much Food your Stomach ne'er oppress
And let it as 'tis richer, be the less.
. . . . . .
Mix Water with your Wine to quench your Thirst,
And never let the last exceed the first.
Fruit, Herbs, and Sallads when the Body's dry
The want of Moisture will as well supply.

DISCUSSION

*A. L. Walters, Tulsa, Okla.:* It seems, from listening to these papers and to the discussion by Dr. Adair that we are apt to make of this problem something that is much too complicated. One of the essayists seemed to infer that diet was wholly within the realm of the pediatrician; that we as dentists should think exclusively, or wholly, of the mechanical side. As a matter of fact, much of the research work as it relates itself to the building and the maintenance of teeth and their supporting structures has come from dentists and physiologic chemists, not physicians; and I would not have any dentist go away from here feeling that he was not within his rights when he studied and prescribed those things which are, in a large measure, essential to the development of teeth, their supporting structures and maintenance of mouth health in the child or adult. I see no reason why we, as dentists, should depend wholly on the pediatrician, much as I value his service. No man esteems the physician more highly than I. Much of the valuable knowledge that I have has come from physicians. I have always said that we, as dentists, are nothing more nor less than an arm of the trunk—the trunk being general medicine. The fingers and thumb may be likened to specialists in den-

13. Bar, Paul: Lecons de Pathologie Obstetricale, Paris: E. Copiomont & Cie, 1907.

tistry—the arm to general dentistry. If we desire to be well grounded, we must follow our specialty not only back to the arm but must return to the trunk or what is termed general medicine, which embodies all the fundamentals upon which our specialty is grounded except the mechanical phase. By the great mass of physicians, as well as dentists, this comparatively new subject of dietetics is not well understood; and since this knowledge is quite as essential to the practice of dentistry as to the practice of any other phase of medicine, dentists have a perfect right to study and to prescribe or outline diets for their patients (young or old) who show any evidence of oral disease. I will go further than Dr. Adair, and say that I should feel criminally careless unless I stressed the necessity for proper food for a pregnant woman, a nursing mother, a child or any adult. For years, I have insisted that my patients go to their physician for a thorough physical examination at least once each year, and always inquire whether they are under the care of a physician for any cause, and if so, I state that everything must be left to him. If they are not being treated for any organic disease and the examination chart shows none, I have not the slightest hesitation in outlining their diet. Unless I can have their cooperation in diet and mouth hygiene, my services will be of little permanent value to them, for to me oral disease, in the main, is merely a local symptom—a visible manifestation of trouble further back in the trunk—and, invariably, close inquiry will reveal that it is primarily dietary in origin. Chewing is valuable to a degree that few realize, and lack of exercise of the teeth may cause considerable trouble; but we must correlate and properly evaluate all the factors entering into the development and maintenance of the teeth and their supporting structures. We may have a splendid denture and supporting structures even though there is a complete ankylosis of the mandible. Given a diet rich in all the organic salts and vitamins, even though that diet be liquid, it is possible to develop and maintain normal supporting structures and to keep the teeth free from caries. I had occasion to see such a case at the Mayo clinic last week, and I knew of another in Kansas City in which there was complete ankylosis. The patient died from an embolus and examination of the mouth revealed normal supporting structures, normal teeth in normal occlusion and no evidence of caries. Perhaps you will say this clouds the issue, but I don't think so. The diet was largely milk, fruit and vegetable juices—an abundance of all the organic salts and vitamins. Dr. Schlutz stressed an important phase of the subject in discussing the acid-base equilibrium. Many individuals for long periods live on a diet the end product of which is preponderantly acid: white flour, white sugar, coffee, peeled potato, and meat diet—a dearth of most of the organic salts, calcium in particular, and also of the vitamins. There is much for us to learn but great benefit will come to the individual who gives up meat for milk, and refined flour and meal breads for fresh whole grain products, and eats more leafy fresh green vegetables and fruits. In my part of the country, certain classes of people live for months upon refined foods and deficiency diets, with the result they have not only sick mouths but sick bodies as well. If they could have bread made from freshly ground whole wheat and whole corn, raw cabbage, greens, molasses and milk, mouths and bodies would show a change for the better. The education of these tenant farmers, cotton raisers, is not going to come from the pediatrician for the small towns and villages do not support them; and the average physician knows less of dietetics than the average dentist, for the dental profession has been studying this subject, in our state, intensely for several years. Therefore, I say once more that it is within our realm, and we are not doing our whole duty unless we inform ourselves and our patients that good teeth and healthy mouths are found only in those who have healthy well nourished bodies, and that proper diet is essential to the proper development and growth and maintenance of health, general and oral.

*Robin Adair, Atlanta, Ga.:* These papers contain more valuable information than dentists are able to absorb and discuss, especially without having studied the papers. It would have been a fine thing for this section if, at the time of reading these papers, the motion picture program could have been shown here. The United States Public Health Service is showing pictures on the "Science of Life," and these lectures just given us are explanations of these pictures.

It is an interesting thought that the profession of dentistry is moving youthward. Our work a few decades ago was entirely with the adult. Formerly, we did not care much about a child's tooth. Now we are moving on down the line from the youth to the child, and are coming to the prenatal period. It behooves us to work with these physicians to see that a good groundwork and foundation structure are given to us to work on. What would this 32-story tower that they are building just a block from this Auditorium be if the foundations were not well prepared and strong? The essayists should continue to work on this problem. I don't believe that they have been taking it up so seriously as they ought to, and we dentists should at every opportunity (when we have a physician as a patient) insist on his helping us to prepare a proper foundation. I know of one mother whose first child had perfect bony structure and teeth. The delivery was difficult. In her second pregnancy, she read an advertisement of easy delivery, so she bought the medicine advertised. The delivery was easy, but the child was lacking in bony structure and the teeth had practically no enamel. In another case, the prospective parents both had very poor teeth. I determined to try an experiment. The wife did not like milk and she would not eat any whole wheat because it scratched her throat and she did not like the taste. But I persuaded her to follow my suggestions, and the child was born with large bony frame, heavy enamel and double cusps on nearly every tooth; and instead of spreading the arch, we are trying to contract it. So it can be overdone. The question of food is one that dentists are working on very hard. In the American Academy of Periodontology, we have had several papers by Sherman L. Davis on diet. I am not yet convinced on some of these food theories. And dentists are prescribing all kinds of foods. We must remember that when the Bible was translated into the language of the Eskimo, because they had no word for "wine" they had to translate it "whale blubber." In every section of a country that you go into, the diet is different, and yet teeth are produced everywhere. The Chinese eat that simple food rice, least in nutriment, and yet they have good teeth. The problem will have to be worked out by further experiment and investigation. But it is safe to do this: We can insist on our patients taking convey to mothers is to be careful about enough milk. You will be surprised to find out how few mothers will drink milk, and they certainly are not going to eat wholewheat bread unless urged to do so. Now I do not believe in dentists going much further than that. We have no right to prescribe a diet, because there are so many complications that might come up in the field of a medical man and a medical man only. But we can work through the medical man. Dentists are within their limits in advising that plenty of milk and plenty of wholewheat bread be a part of the diet. Dentists are now alive to the situation. This audience shows it. Ten years ago, an audience on preventive dentistry this size could not have been held in a national convention. We are looking after children's teeth more and more, and we are going to stop some of this decay if we can get the foundations built properly. Another thing: The mother ought to look after the teeth. As soon as the teeth erupt she should bring the child to a dentist, and she should insist that the child brush the teeth efficiently. But if they are not brushed we can at least sterilize the grinding surfaces of the teeth and cover them over with cement until they are ready for active service. Look at the moving pictures shown by the mouth hygiene committee and see those children caught at random eating at a picnic. Chew? They could get along just as well without any teeth at all. But let us teach them first to chew and give them something to chew, and then the dentist's part is to instruct the patient and fill every little pit and fissure before it becomes a cavity.

*Lawrence Leonard, St. Cloud, Minn.:* It is most encouraging to hear that the fetus is more or less of a parasite in its metabolism. If we study the history of mankind before the modern propaganda of diet was launched, we discern that the teeth were good and that Nature, if it is only given a chance, will take care of the fetus. This was brought out distinctly. We need not worry, to any great extent, provided the prospective mother is supplied with reasonably natural food, not artificial. The latter is what we must take cognizance of, this artificial preparation of food and consumption of artificial things which pervert our taste. Dr. Adair spoke of sugar. One of the great lessons or points which we should

putting that first teaspoonful of refined sugar on the first cereal given the baby, when it is about 5 months old. This marks the commencement of a perverted taste. From this time on, there is sugar, a little more sugar, and still a little more sugar added to its diet. One mother said to me, "My child 5 years of age has four abscessed teeth." I asked her why. She answered, "The child had to have his breakfast cereal covered so thickly with sugar that it was a batter." One of the things which we must stress is that the taste of the human race must not be perverted. It is a biologic principle that when carbohydrates and *Bacillus acidophilus* come together, in a favorable medium, the resultant product is lactic acid and that this acid dissolves enamel.

*F. W. Schlutz, Minneapolis, Minn.:* I would not have my dental colleagues understand that the pediatrician wishes in any way to take anything away from the dentist. We do not care to walk alone; we will be stronger if we walk in company. The medical man and in this instance the pediatrician is pleading for cooperation between the medical and dental professions. We will serve the interest of our patient better if we have it. The physician is quick to recognize abnormal mouth conditions and promptly turns to his dental colleagues for help. It will be well if the latter will, in the same way, readily and promptly recognize that there are deep underlying causes for dental disease which involve conditions falling more within the sphere of his medical colleague. The problems and conditions underlying dental disease are by no means simple. It is my experience that some of them are growing more complex. This is surely true in the field of nutrition and metabolic disorders. The literature, for example, which has accumulated on acid base metabolism is enormous. To comprehend it well is a task of the first magnitude. It is very difficult indeed for any one man to be conversant with such complex problems. The part of wisdom would be to divide the interests and then cooperate to make them useful. I would once more like to call your attention to the subject of preventive dentistry and the periodic dental examination as a part of a routine public health examination. The dentist must not make the mistake made still by many medical men, and that is, to treat only the sick and disregard or take no interest in the well person. The age of preventive medicine is upon us. It is the cry of the age—not to practice it is like not seeing the sun at noonday. A subject I briefly touched on in my talk, I should like to refer to again. It concerns my colleagues who are practicing orthodontia. In my experience in this city, I am sorry to say, this excellent specialty of dentistry is still quite beyond the reach of people of moderate means. I do not know why this is so and whether it really need be so. There are no doubt excellent reasons economic or otherwise why this type of dental work is almost prohibitively expensive, but I really believe and I hope that the dental profession will recognize that some means must be found to bring this really excellent and needed service within the reach of all. If it is difficult to do this, we must turn to the great foundations or philanthropies to provide endowment so that this service can be within the reach of every child who may need it.

*Fred L. Adair (closing):* As far as the patient is concerned it makes little difference whether the physician or the dentist prescribes the diet, as long as it is prescribed properly. But as a matter of cooperation and courtesy between two professions, it seems to me that it might be well to have a definite understanding about the situation. If the obstetrician or general practitioner in examining a pregnant woman finds any difficulty with the teeth, he is very apt to refer the patient to the dentist. I presume that if the dentist has a patient come to him with some oral condition and he learns that she is pregnant, he will recommend some practicing obstetrician who is capable of diagnosing and managing the condition. As far as the diet itself is concerned, there should be no conflict between a diet which is beneficial or detrimental to the oral condition and one which is beneficial or detrimental to the general condition. The dentist might possibly, through not recognizing some pathologic condition in the prospective mother, prescribe a diet which might be harmful to the general condition. It seems to me that both the dentist and physician should recognize that the general condition is the more important. In other words, if the woman had some pathologic condition which required a special diet which might be detrimental to the oral condition, we would necessarily have to prescribe the diet which was beneficial to her general condition.

# PRESENT STATUS OF THE TREATMENT OF PERIODONTOCLASIA (PYORRHEA)*

By E. J. WEAVER, D.D.S., Milwaukee, Wis.

TODAY, different schools of thought delving deeply into the etiology and pathology of pyorrhea give to the profession amazingly valuable facts concerning its origin.

The great debt that we owe to G. V. Black and Harold Keith Box, to mention some outstanding figures in this research, can never be repaid. We have not the facilities and training for this work, as our time is employed in handling these cases clinically, so we must accept the findings of the men at whose feet we bow. But this valuable and interesting knowledge, for instance of the classification of morbid conditions associated with these abnormal conditions of the periodontium, does not help us so materially as we would wish in handling these cases clinically. So, in turn, we must keep the research workers in touch with what we learn in actual experience in working with these cases every day.

It would seem, in studying closely the whole situation in regard to methods of procedure, that we are confronted with the fact that different schools of practice and different personal ideas concerning the cause or causes of periodontoclasia often seem to run on a tangent, perhaps too far along some one line, which, in their opinion, is deemed the positive cause of the trouble.

To illustrate, we will say that one school is of the opinion that faulty diet is the prime factor in its inception. Another school firmly believes that abnormal occlusal stress or traumatic occlusion is the all important causative factor, even to the point of eliminating all the others. Others believe that want of hygienic care of the oral cavity is the important thing to be considered in its origin. These, I think, are the principal causative ideas, which in their ramifications are often stressed, sometimes one or another at the expense of the others.

Locally today, methods of operation range all the way from mild scaling, medication and polishing, to the most radical surgery. Of the local methods, the one to be used, naturally, is the one that produces the most lasting results.

In the earlier days, say fifteen years ago, courses were given all over the country which consisted mainly in removing all deposits, planing all rough surfaces and polishing the exposed portions, according to the fancy of the operator. Hours were often spent in this final glossing, without having in mind the process margins, where destruction of bone is always occurring in true pyorrhea. There is little doubt that this treatment is still being employed, as a

*Read before the Section on Orthodontia and Periodontia, at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 23, 1928.

curative measure, and this method had in it much to commend as an improvement over what we had been using. But, since our postoperative cases accumulated, while some of them must have been successful, others were not. The conscientious man, specializing in this work, gradually began to ponder and ask himself questions.

Of course, we knew that the teeth and supporting structures were a part of, and associated with, the head, but just a few years ago, considering the treatments being employed, we seemed only dimly aware that the head was an integral part of the body, and that the teeth and periodontium could not escape being affected by abnormal conditions elsewhere in that same body. This was the first basic idea that forced itself upon our consciousness, and this plain fact, strange as this may seem, was often lost track of in our earlier treatment of pyorrhea.

Admitting the truth that the head is a very important part of the body, if the patient's vitality generally is low, owing to deficiency in the blood stream as a result of wrong diet, faulty assimilation, poor elimination and so forth, we naturally would expect to and usually do find the supporting structures of the teeth in that same state of low vitality. As a further reason, we must remember that teeth are end-organs and transitory structures. At this point, would not this query confront us: "Why shouldn't we treat the teeth and the mouth in general in the same manner that the diagnostician and the surgeon would treat any other part of the body?" And this question suggests the most important one along this line of thought: "What first should be considered clinically in starting treatment in case of pyorrhea?" From our present knowledge, the only sensible answer which could be given to this question, would be, "The general health of the patient."

I am endeavoring to put this article in the simplest terms possible. We have plenty of scientific treatises in our literature, which sometimes tally with the clinical findings and which sometimes do not, and in trying to arrive at what the present status of treatment should be, we are basing our opinion not on the results different treatment show after a month or a year but on the evidence of permanent cure that meets our inspection after five or ten years have elapsed. This evidence is based on laboratory findings but, with a fair knowledge of etiology and pathology, on personal observation of several hundred cases treated by different methods, observation meaning clinical examination including roentgen-ray findings covering a period of twenty years.

In this discussion, I shall not lose track of the so-called vicious circle in considering this disease and its treatment. By vicious circle, the idea is conveyed that pyorrhea may and does occur as a result of physical derangement elsewhere in the body, an outstanding example being diabetes. But pyorrhea, even localized over a small area in the mouth, originating from irritation or trauma, often associated with devitalized teeth, may be, and often is, the focus for the production of bacteria which find their way into the blood stream, lowering the vitality generally. In turn, this lowering of resistance generally, which includes the head, as we said in the beginning, is one of the important factors in the spreading of the condition to other teeth in the mouth. So the vicious circle closes.

The term circle is opportune, illustrating just what I shall attempt to explain

and stress at this point. When a patient calls to see us for the first time, and we are talking now of advanced cases in which our judgment tells us that what we see in the mouth is clearly a local manifestation of a physical condition, shall we begin by attempting surgical work or medicinal treatments, without a careful physical diagnosis as to the underlying causes for the inception of the local condition that is so evident? Surely, as modern dentists, we would not proceed to attack this point in the vicious circle only.

Now just what is the correct procedure in these advanced cases? At this stage in the diagnosis, the dentist is facing a great responsibility. We have in our hands the roentgenograms of the case which have been taken in advance of this diagnosis. Usually, some superficial prophylactic care in the way of a pre-treatment by the operator or the hygienist, as indicated, has been given, as well as the correcting of any serious traumatism. Is this all that is necessary before we start treatment, whether it is to be leveling of the bite and mere scaling and instrumentation or something in the way of mild or intensive surgery?

We shall pause here and discuss briefly the old argument "How much has the physical condition of the patient to do with what often is believed to be a purely local disease?"

That there is a connection between systemic conditions and pyorrhea has been recognized for years. Bunting[1] cites a controversy between the constitutionalists and the localists which dates back to the very beginning of our knowledge of pyorrhea. The discussion was so strong that the question was finally submitted to a commission of scientists appointed by the Société de Chirurgie of Paris.

Talbot,[2] in 1921, in reviewing his former work on the subject, restated his former assertions that pyorrhea is a disease which is local in its manifestations but is due to both local and constitutional conditions.

Through all of Talbot's[3] early writing, and they were clear and understandable (I am now quoting Dr. Bunting), he, Talbot, has recognized the importance of certain local causative factors, such as infection and calculi, but he believes that the most significant factor in the process is a preliminary degeneration of the alveolar process. He points out that, in the evolutionary development of man, a marked degeneration of the alveolar process has occurred, with the result that, in the present generation, these bony structures are lightly built and are prone to degenerative changes under any stress or nutritional disturbance. He states that the initial lesion consists in preliminary degeneration of the alveolar bone, due to senility, intoxications, malnutrition or other constitutional fault. Local irritative factors, then, acting in conjunction with the underlying degenerative changes, may produce the characteristic lesions of the disease.

In reviewing the literature, Dr. Bunting states:

> In conclusion it may be stated that the writer, Dr. Bunting, agrees with Dr. Talbot when he says that pyorrhea is a constitu-

1. Bunting, R. W.: Dent. Cosmos, 64:731 (July) 1924.

2. Talbot, E. S.: Late Researches in Interstitial Gingivitis, Dent. Cosmos, 63:795 (Aug.) 1921.

3. Talbot, E. S.: Dent. Cosmos, 38:310 (April), 660 (Aug.) 1896; 51:1147 (Oct.) 1909; 57:485 (May) 1915; Dent. Summary, 23:435, 538, 1903; 37:282, 1917; Dent. Items Int., 28:837 (Nov.) 1906; Interstitial Gingivitus, Dent. Items Int., 21:779 (Nov.) 1899.

tional disease in that it is often associated with nutritional fault and systemic intoxication or disturbances and he also agrees with those who hold that it is caused by local injury and infection. That is, that careful diagnosis will reveal both local and systemic factors active in every case.

We note that, a number of years ago, Talbot was trying to understand this preliminary degeneration of the alveolar process and he seemed to think that malnutrition or other constitutional faults entered largely into the process. Whatever our opinion may be in the whole matter, it is the sensible thing to try to eliminate, as much as possible, the physical connection which most authorities admit exist.

I am forced to believe more and more every day that whatever the cause of pyorrhea may be, if we start our treatment with the elimination of the physical influence, our prognosis can be much surer and our final results will be much more gratifying.

In cases of gingivitis, in young people in their teens or early twenties, we so often find constipation linked up with wrong diet, want of proper exercise, etc., especially in young women. These patients are apt to come back after prophylactic treatments, no matter how carefully they have been instructed in brushing, with a return of the marginal inflammations. But when proper diet and proper exercise, which usually eliminates constipation, have become a habit and a more normal condition of health has returned, we had no trouble in keeping the mouth healthy. In fact, the recurrence, in these cases, before careful attention to the physical condition was insisted on, was more troublesome than the advanced cases.

In some advanced cases that I had struggled with for years without satisfactory results in regard to recurrence, the patient was suddenly found to have diabetes, or had, for example, an acute attack of hemorrhoids and was obliged to receive medical or surgical attention. In the diabetic cases, the patient must have very careful local attention, but if the sugar is kept in abeyance, these cases are successful. In hemorrhoid cases, when the trouble had been successfully eliminated, we soon noted improvement of a permanent nature in the oral condition.

That there is a local as well as a physical cause for these mouth derangements is no doubt generally true. But my experience holds records of a number of cases in which I was unable to detect anything in the way of traumatism or irritations from mechanical sources. Outside of probable predisposition, which later amounted to real physical cause, we could ascribe a local condition only in the way of perhaps some neglect in home care.

We usually have before us, if the case is far enough advanced, a patient who is apparently not in the best of health. Sometimes the patient may appear nearly normal; but is he? We naturally wish to do our part, if the patient is physically below par, in bringing him back to health. How can this be best accomplished? Shall we send the patient to the medical diagnostician for a general examination before going further, or shall we, for our own satisfaction, make a preliminary check-up? Today, the doctor of medicine is being more generally called the physician to differentiate him from the doctor of dentistry. A commonplace definition of a physician is "one who heals the sick." If we are to uphold the responsibility now placed on us by the medical profession, it should be

the business of the dentist to help in healing the sick.

Why shouldn't the dentist, who is specializing in these cases, after the roentgenograms are taken, take or have taken in his office a blood count, with special care given to the differential count? This was started as purely an experiment in my office, and there seem to be rather definite findings. Studying these differerential counts briefly, we find that usually in a low red count, and with or without a variation in the leukocyte count, where we find a diminution of the polymorphonuclear count with a raising of the small and large lymphocyte count, we can expect to find head infection, in teeth, tonsils or accessory sinuses.

In scanning our literature we find more or less confirmation of this. (R. L. Haden,[4] W. A. Price.[5]) Toren[6] describes a special mononuclear irregular granular cell, which he found in the blood stream in connection with chronic oral infection, and absent when no such infection exists. He classified this cell as a large lymphocyte. No later research by Toren sheds any further light on his findings of that time, but other men, as noted by I. A. Epstein,[7] working with his ideas in mind, are inclined to doubt that this cell is a lymphocyte. (Judson Daland.[8]) Daland has given us some very definite information in regard to lymphocytosis and the relative decrease of polymorphonuclear cells in oral infection. He also found the percentage of cases showing lymphocytosis higher in patients having oral foci than in those having tonsil or multiple foci. Of course, it is needless to explain that we are dealing with the same form of bacteria in pyorrhea sinuses that we are in apical infections.

But one gets somewhat confused at the variance in findings of these different research authorities. One can but read them carefully, draw one's own conclusions and then note how one's own experience compares with that of these authorities.

In studying over 200 of these counts, we are quite sure of one thing, that different men or laboratories do not see the same things or make the same count in studying these blood pictures. Especially do they differ greatly in regard to the small and large lymphocyte count. They also vary in the polymorphonuclear count. We have tested this out a number of times with the same blood specimen. To reach any definite conclusions with our subsequent check-up, we must have the same technician make the recount.

We will assume that if we found an abnormally low red count or an abnormally low or high leukocyte count, the condition would come in the province of the general diagnostician. If, associated with a low red count and low color index, we found a low polymorphonuclear count and a high small and large lymphocyte count, we would, with our experience in mind, as well as the experience of others which I have noted, at least suspect head infection, and it is our experience that, with such counts, we

4. Haden, R. L.: Differential Leukocyte Count in Chronic Periapical Infection, J.A.D.A., 10:596 (July) 1923.

5. Price, W. A.: Dental Focal Infection, J.A.D.A., 12:641 (June) 1925.

6. Toren, J. A.: Diagnosis of Oral Infection by Blood Examination, Dent. Cosmos, 64:917 (Sept.) 1922.

7. Epstein, I. A.: Study of the Blood in Cases with Dental Infection: Preliminary Report, J.A.D.A., 13:1752 (Dec.) 1926.

8. Daland, Judson: Lymphocytosis as Diagnostic Sign of Chronic Periapical Dental Infection in Adults, J.A.M.A., 77:1308 (Oct. 22) 1921.

often find it. We must not overlook our field in head infection; namely, the surrounding structures of the teeth, which take in the root-end areas. Some authorities are of the opinion that periodontoclasia is a more dangerous focus for the production of low grade infection than a pathologic process in the root-end areas. (Blanquie.[9]) "In some cases apical infections are encapsulated, and their toxic agents are walled off from the blood circulation, but in periodontoclasia, no such protection exists and each case presents a potential menace."

Shall we, at this time, advise the patient to take our roentgen-ray findings, with a brief history, which it would seem wise for us to keep in our records, to the family physician or to a reliable diagnostician for a check-up?

Very often, in taking this brief history, we learn valuable facts in regard to operations, periods of low vitality, faulty elimination, want of normal exercise and faulty diet. Patients usually agree with us in following this procedure, for they are aware that we are trying to do all in our power to make the results that we hope to get permanent.

The diagnostician also appreciates what we are trying to do and wishes to cooperate with us if we will give him a chance. No doubt, we many times turn over to him a patient that should have seen him long before. Perhaps we have been the means of getting the physician in touch with the patient before something really serious has developed. When the patient returns with the physician's findings, and he has done or is doing his part in the effort to restore his health, we are ready to proceed with a clear conscience.

We have now arrived at the point where we shall be obliged to discuss the advisability of surgery as compared simply to instrumentation of the teeth surfaces and medication. We again ask the question, "What should be the present status in our treatment?"

We are too well versed in the results obtained by a few outstanding men in this work, who look with disfavor on anything surgical, not to admit that it is possible to show satisfactory cases. But can the results that we are anticipating be obtained as quickly and are they as lasting with the same amount of posttreatment care? And with the health view of the case in mind, will the foci for production of infection be as quickly eliminated?

What arguments can we advance against mild or rational surgery? First, that it is not necessary. We will leave that to the personal equation of the man doing the work. Secondly, it leaves the exposed teeth surfaces sensitive. Long experience in the work taught us that the scaling method does likewise. Thirdly, surgery lowers the original gum line. Is not this true of the earlier methods, if they are successful? Isn't the lowering of this same gum line, which some accomplish with their instrumentation and stimulating treatment, the only reason why they show successful results? Do these quotations from Rousch[10] sound reasonable?

**The surgical treatment of pyorrhea is not new; it is just surgery applied to a new field, and if the medical profession had been responsible for the freeing of the mouth from infection, they would probably have applied surgery to the mouth more readily than to any other part of the body,**

9. Blanquie, R. H.: Periodontoclasia and Its Treatment, Dent. Cosmos, 70:170 (Feb.) 1928.

10. Rousch, R. R.: The Surgical Eradication of Pyorrhea, Dent. Cosmos, 70:125 (Feb.) 1928.

because of the disease being so conspicuous, so easily diagnosed and so easy of access.

Surgery to any part of the body is radical, and the only way to avoid it is to prevent conditions requiring it. As long as we have pyorrhea, surgery in indicated, and when the professions have determined the mineral content of the food, the rôle of the vitamins and the ultraviolet rays in calcium metabolism, the composition of the saliva, dietary habits, the general resistance of the patient, oral hygiene measures, regular prophylactic treatments and finally the maintenance of local resistance through masticatory activity, thereby combating disuse and atrophy, pyorrhea will no longer exist.

Box[11] describes a pathologic condition of tissue lying directly under the septal tissue as rarefying pericementitis fibrosa, chronic and progressive lesion of the pericementum that follows rarefaction and destruction of alveolar bone.

Shall we get rid of this diseased tissue, whatever it is, as well as clean out the little germ nests that lie along the border of the alveolar process just as soon as we can in our process of treatment? Shall we not also make the pocket self-cleansing, which is the primary object of surgery? The removal of deposits on the teeth surfaces during surgical treatment is comparatively easy, since they are more accessible and can be easily discerned in this method.

I am not in favor of some of the very radical forms of surgical treatment, but I ask this question, "Isn't reasonable surgical treatment the most sensible method of eradicating the infected tissue, and isn't the chance of recurrence less to be expected in this method of treatment?

What about postoperative treatments? It would seem, after long experience in handling these cases, that the importance of this part of the treatment cannot be overemphasized, and some of the failures which occur in this work can be traced to want of thorough postoperative treatment.

We will assume that most men in this work realize the importance of a set system of brushing. Usually, different operators have a personal method of instructing the patient in that system. The important thing, our experience teaches us, is that these lessons in brushing must be repeated every time the patient is again in our hands, as he is prone to forget or to neglect to be thorough in the use of his brush.

Can there be any reasons advanced why we should not use immediately after surgical treatment the ultraviolet ray as a regular procedure? First, we should use it as an analgesic measure. We can assure the patient that there will be little or no pain for more than twenty-four hours after conservative surgical treatment. Secondly as a therapeutic agent, it prevents infection. Thirdly, it is a stimulating factor in the regeneration of the hard and soft tissues. After watching the wonderful benefits resulting from this form of stimulation used at the Battle Creek Sanatorium, I concluded that it might be useful in our work. As they explain at the sanatorium, in the summer when they can get it, they use the sun. When the sun does not reach the locality, the artificial sun or ultraviolet ray, or some other form of artificial sun's rays is used. There is no more danger in its use in the mouth than there is of overbrushing, as the nurse or attendant need use only ordinary care in its application. One thing that we cannot explain is the fact that its use relieves the sensitiveness in the

11. Box, H. K., and McCall, J. O.: Pathology and Diagnosis of the Basic Lesions of Chronic Periodontitis, J.A.D.A., 12:1300 (Nov.) 1925.

teeth surfaces that usually comes after any form of pyorrhea treatment. We do not insist that this form of stimulation is absolutely necessary, but we do ask whether it is not a very valuable adjunct in our treatment.

Whatever good advice we can give the patient during our contact with him should be given at opportune times, and we can assume that we have at least made a professional friendship during our period of treatment. If we haven't done this, we cannot expect to get cooperation.

We see these patients more often than the physician does, as they return to us for prophylactic treatments as the years go by, and when we can help them in regard to their general health, it would seem our duty to do so. When we cannot help with some simple suggestions, we should not hesitate to advise the patient to seek the advice of the family physician, if our judgment tells us that it seems necessary. Is not a close cooperation between the dentist and physician almost indispensable, if we both wish to be of the utmost service to our profession?

# THE DATES OF ERUPTION OF THE PERMANENT TEETH IN A GROUP OF MINNEAPOLIS CHILDREN: A PRELIMINARY REPORT*

By JOSEPH T. COHEN, D.D.S., Minneapolis, Minn.

THE object of this study was to determine the average dates and the variability of eruption of all the permanent teeth, with the exception of the third molar, in a representative group of 2,848 Minneapolis school children, ranging in age from 5 to 15 years.

but otherwise no conscious selection was made, and the children were examined seriatim as they were presented. They represented a presumably normal, healthy group of highly mixed nationalities, with descendants of northern European

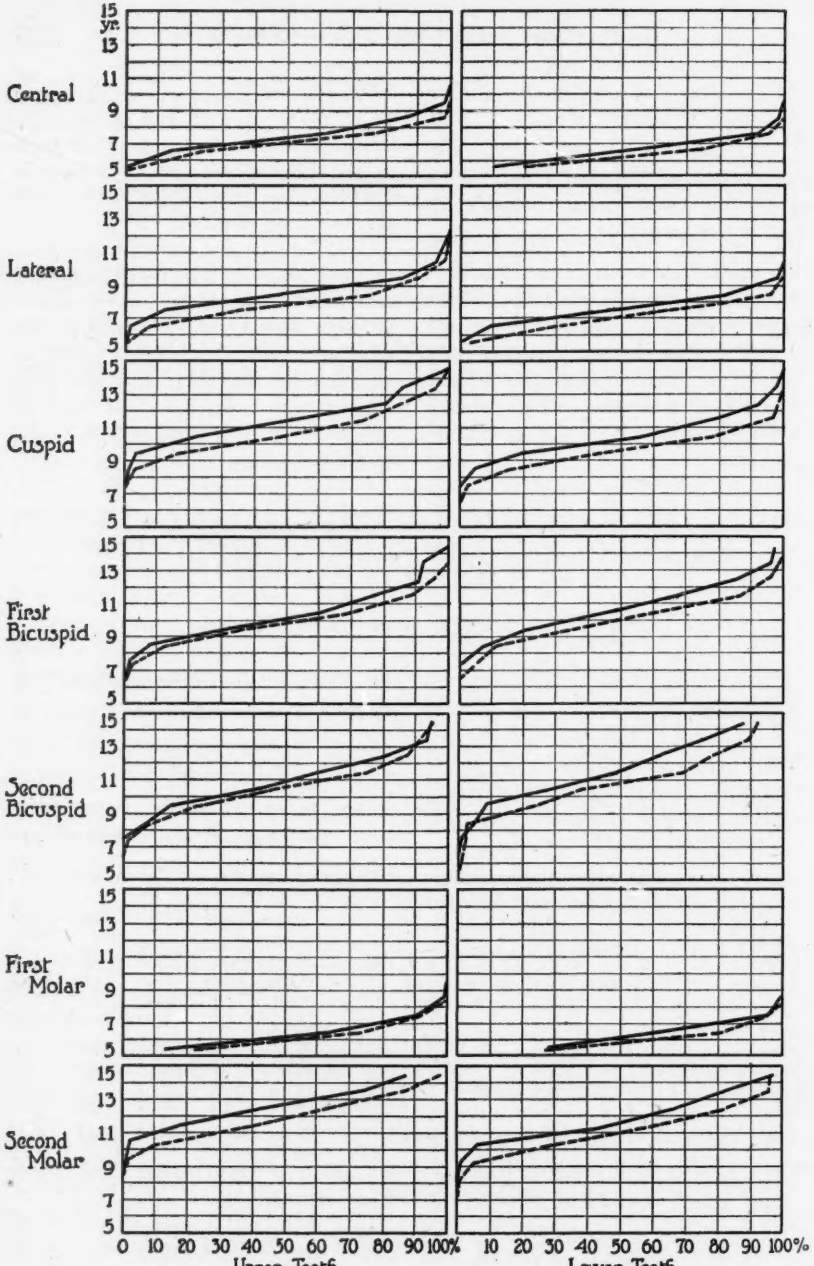
TABLE 1.—MEDIAN AGE AND SEMI-INTERQUARTILE RANGE OF ERUPTION OF PERMANENT TEETH IN A GROUP OF 2,848 MINNEAPOLIS SCHOOL CHILDREN

| Tooth | Upper Teeth | | | | Lower Teeth | | | | Upper and Lower Teeth Combined | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Males | | Females | | Males | | Females | | Males and Females | |
| | Median Years | S.Q.R. Years | Median Years | S.Q.R. Years | Median Years | S.Q.R. Years | Median Years | S.Q.R. Years | Median Years | S.Q.R. Years |
| Central incisor.... | 7.1 | ±0.6 | 6.9 | ±0.4 | 6.4 | ±0.4 | 6.1 | ±0.3 | 6.6 | ±0.4 |
| Lateral incisor..... | 8.6 | ±0.6 | 7.9 | ±0.7 | 7.5 | ±0.6 | 7.0 | ±0.7 | 7.7 | ±0.6 |
| Cuspid .....11.5 | | ±1.0 | 10.7 | ±1.1 | 10.3 | ±0.8 | 9.6 | ±0.7 | 10.5 | ±0.9 |
| First bicuspid.....10.2 | | ±1.0 | 9.9 | ±0.8 | 10.8 | ±1.0 | 10.1 | ±0.8 | 10.2 | ±0.9 |
| Second bicuspid....10.7 | | ±1.1 | 10.7 | ±1.0 | 11.4 | ±1.6 | 10.8 | ±1.1 | 10.9 | ±1.2 |
| First molar..... | 6.4 | ±0.4 | 6.1 | ±0.5 | 6.4 | ±0.5 | 5.9 | ±0.5 | 6.2 | ±0.5 |
| Second molar.....12.8 | | ±0.8 | 12.2 | ±0.8 | 11.8 | ±1.0 | 11.6 | ±0.8 | 12.1 | ±0.9 |

The material was gathered from different parts of the city of Minneapolis, extraction predominating, and came from all social classes.

The data recorded for each child included the name, address, date, age in years and months, school, grade in

*From the Institute of Child Welfare, University of Minnesota.




Frequency of Presence of the Permanent Teeth (2848 observations)
—— Male ----Female

Figure 1.

school and sex. All the erupted permanent teeth in the mouth were carefully noted.

The treatment of the data was as follows: The ranking or percentile method rather than the more usual one of averages was used. The material was first divided by sexes and then arranged in yearly groups. The frequency of presence of each tooth (in the form of a percentage of the whole group) was determined for each yearly group for each sex. These values were then charted in the form of percentile or "ogive" curves (for each tooth), by connecting these percentage points for the successive years. These curves are shown in Figure 1, illustrating the eruption of the upper and lower permanent teeth.

The measure adopted for representing the "usual" time of eruption of each tooth was the fiftieth percentile or median value, or the approximate time at which the tooth was present in one half of the individuals of the group. This was determined by finding the point on each graph where the percentage curve passed the 50 per cent line, and reading the corresponding age by projection to the base line of the graph.

The median age gives a measure of the "average" or "usual" time of eruption of the teeth. The variations from this average age are shown by the "semi-interquartile range" (S.Q.R.), which is determined by subtracting the age at which each tooth is erupted in 25 per cent of the cases from the age at which

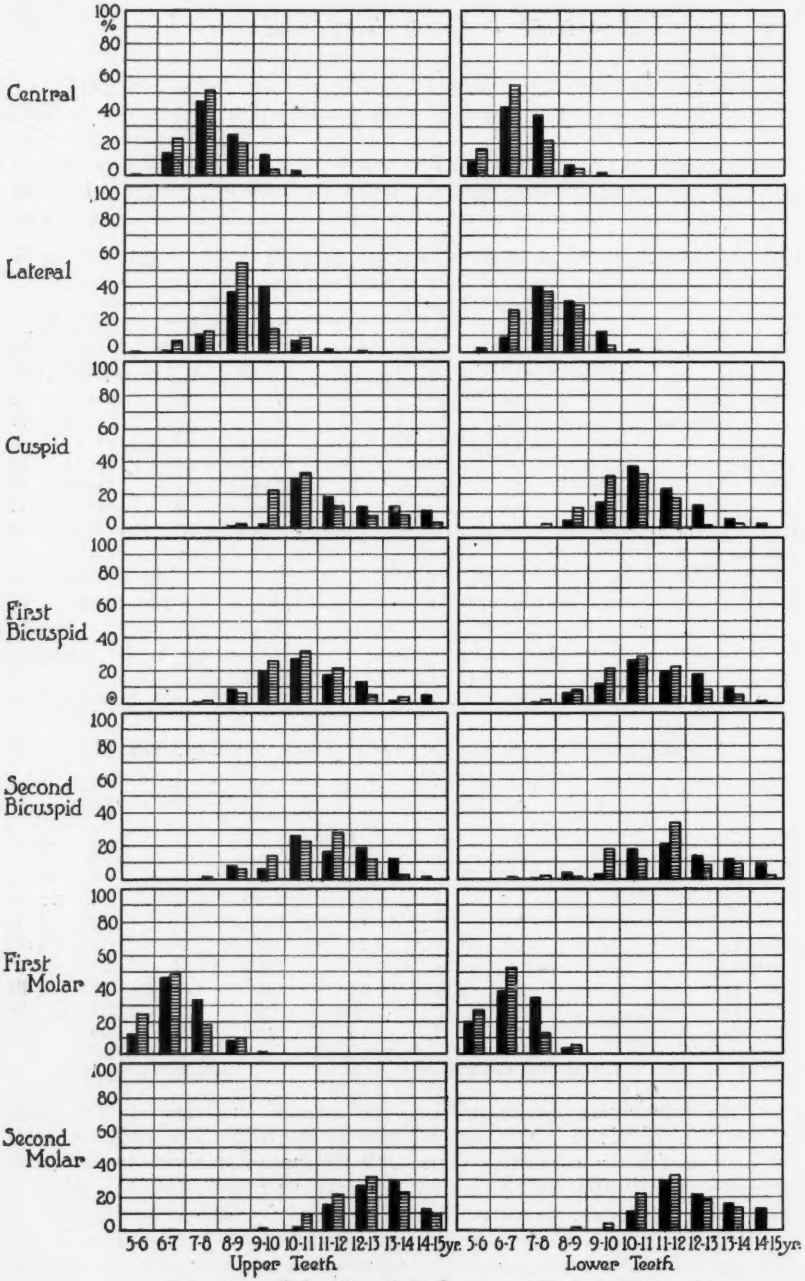
TABLE 2.—APPROXIMATE PERIODS OF MOST FREQUENT ERUPTION OF THE SEVERAL PERMANENT TEETH IN A GROUP OF 2,848 MINNEAPOLIS SCHOOL CHILDREN

| | Males | | | | Females | | | |
|---|---|---|---|---|---|---|---|---|
| | Upper Teeth | | Lower Teeth | | Upper Teeth | | Lower Teeth | |
| Tooth | Approximate Period (Years) | Frequency (Per Cent) | Approximate Period (Years) | Frequency (Per Cent) | Approximate Period (Years) | Frequency (Per Cent) | Approximate Period (Years) | Frequency (Per Cent) |
| Central incisor | 7 to 8 | 46 | 6 to 7 | 43 | 7 to 8 | 52 | 6 to 7 | 56 |
| Lateral incisor | 9 to 10 | 40 | 7 to 8 | 40 | 8 to 9 | 54 | 7 to 8 | 38 |
| Cuspid | 11 to 12 | 29 | 10 to 11 | 36 | 11 to 12 | 34 | 9 to 10 | 31 |
| First bicuspid | 10 to 11 | 28 | 10 to 11 | 27 | 10 to 11 | 32 | 10 to 11 | 27 |
| Second bicuspid | 10 to 11 | 27 | 11 to 12 | 22 | 11 to 12 | 29 | 11 to 12 | 34 |
| First molar | 6 to 7 | 45 | 6 to 7 | 39 | 6 to 7 | 49 | 6 to 7 | 53 |
| Second molar | 13 to 14 | 30 | 11 to 12 | 30 | 12 to 13 | 23 | 11 to 12 | 33 |

TABLE 3.—AVERAGE NUMBER OF ERUPTED TEETH AT A GIVEN AGE*

| | Males | | | | Females | | | |
|---|---|---|---|---|---|---|---|---|
| Age | Number of Observations | Upper Teeth | Lower Teeth | Total | Number of Observations | Upper Teeth | Lower Teeth | Total |
| Years | | | | | | | | |
| 5.0 to 6.0 | 39 | 0 | 1 | 1 | 59 | 1 | 1 | 2 |
| 6.0 to 7.0 | 78 | 2 | 3 | 5 | 90 | 2 | 4 | 6 |
| 7.0 to 8.0 | 157 | 3 | 5 | 8 | 177 | 4 | 5 | 9 |
| 8.0 to 9.0 | 176 | 5 | 6 | 11 | 178 | 6 | 7 | 13 |
| 9.0 to 10.0 | 222 | 7 | 7 | 14 | 215 | 7 | 8 | 15 |
| 10.0 to 11.0 | 242 | 8 | 9 | 17 | 242 | 9 | 10 | 19 |
| 11.0 to 12.0 | 223 | 10 | 11 | 21 | 243 | 11 | 12 | 23 |
| 12.0 to 13.0 | 128 | 11 | 11 | 22 | 141 | 12 | 13 | 25 |
| 13.0 to 14.0 | 66 | 13 | 13 | 26 | 71 | 13 | 13 | 26 |
| 14.0 to 15.0 | 57 | 14 | 14 | 28 | 44 | 14 | 14 | 28 |

*Values given to the nearest whole number.




Percentage of Eruption of the Permanent Teeth at Various Ages

■ Male ■ Female

**Figure 2.**

the same tooth is erupted in 75 per cent of the cases, and then dividing the result by two. The semi-interquartile range subtracted from and added to the median shows the period within which the tooth under consideration erupted in one half of the children in this group. Table 1 shows the median age and the semi-interquartile range for the eruption of teeth in the group of children.

A second calculation was made of the percentage or relative frequency of eruption of each tooth in each sex and each year. In this instance, the total number of each of the teeth erupted at each year was first determined. Then the percentage of eruption in each year was subtracted from the percentage of erupted corresponding tooth of the year following. The resulting figure is a rough measure of the percentage frequency of eruption of each tooth in each year. For example, 66 per cent of the male children between 7 and 8 years of age showed erupted central incisors, and 20 per cent of the children between 6 and 7 showed erupted central incisors. Therefore, in 66 minus 20 per cent, or 46 per cent, of the male children, the central incisors had presumably erupted between the median ages of these two groups.

A third procedure was to compute the mean or average total number of teeth present in the mouth at various ages in childhood. This was done by summing all of the teeth present in the mouths of all the children in the several yearly periods, and then dividing by the number of individuals examined. In this instance, no attempt was made to divide the material into groups, except as to sex and to upper and lower teeth. Thus, for example, there were 223 male children between 11 and 12 years of age, and the total number of permanent teeth erupted in this group was 2,459, or an average presence of 11+ teeth.

## CONCLUSIONS

In general, the following preliminary conclusions may be drawn from the material examined in this survey, and are illustrated in the charts and tables:

1. The lower permanent central and lateral incisors erupt about a year earlier than do the corresponding upper teeth. The lower permanent molars erupt about four months before the corresponding upper teeth, and the lower bicuspids erupt somewhat later than the upper bicuspids.

2. There is approximately one more permanent tooth in the lower jaw than in the upper jaw at any given age in the period under consideration.

3. The teeth of the females erupt, on the average, about five months earlier than do the corresponding teeth of the males.

A more detailed report on this subject, including a more extensive series of observations and a discussion of the findings of previous investigators in this field, is in the process of preparation.

## DISCUSSION

***Russell W. Bunting, Ann Arbor, Mich.:*** What period or stage of eruption was designated as the time of eruption?

***Dr. Cohen:*** We found in our investigation that it was hard to designate just what an erupted tooth was; that is, how far it was erupted. Therefore, in this particular survey, when we saw a tooth, that is, when cusps showed outside the gums, it was considered to have erupted. But there were very few of these teeth whose eruption was in question; most of them were perfectly erupted.

# INTRA-ORAL CYSTECTOMY*

By A. B. VASTINE, D.D.S., Danville, Penn.

THIS paper presents a study of those pathologic areas of the maxilla and mandible, or extensions therefrom, that are characterized by a well-defined, walled-off or circumscribed boundary.

It is a broad field to include under the term of intra-oral cystectomy, but when one considers the mechanism of the cyst in its broadest sense, one may readily conceive the comprehensive operative span that is involved. By regarding the cyst as the delimiting mechanism erected in response to stimuli within the structure involved, it will be found that there is a wide range of conditions to which the term cyst may be applied and for the relief of which a cystectomy is performed.

The most minute formation brought into being as a circumscribing mechanism for a periapical or a periodontal infection has all the elements of the cyst, and its removal, in reality, constitutes a cystectomy. It matters not how it may be done, whether it is incidentally done through the mere extraction of the tooth or by an extensive premeditated operative procedure.

It is our purpose to discuss only such physiochemic barriers as have been erected in response to periapical, gingival, traumatic or developmental stimuli, bringing to your attention such of those reactions as have not been cleared when the cause was removed or that do not lend themselves to removal through the ordinary elimination of the causative factor.

There are certain obvious facts connected with the regional anatomy that must be appreciated in the recognition of these cysts, residual areas, granulomas, medullary infection, rarefying osteitis or whatever term designates the persistence or extension of the reactions in the supporting structures of teeth due to infection or other stimuli.

A knowledge of the normal is especially necessary when a state of affairs is brought about that does not commonly exist in similar structure in other parts of the body. This is due to certain peculiar anatomic and physiologic factors which we will briefly consider the pertinent ones. The structures concerned are very susceptible to variations not so common in other parts. This natural variation increases the range of vulnerability and complicates the proper evaluation of the pathologic departures from the normal.

The structures concerned are made more vulnerable because of the unusual portal for entrance afforded the causative organisms by way of structure that has not the usual mechanism for protection in the same degree as other parts.

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 21, 1928.

It is needless to mention that the teeth have little or no faculty for restoring lost tissue as have other parts. It is a fact that these portals for entrance conduct the organisms to deep structures that have a wide range of reactive power, not reacting at all times in a given way. It is not within the province of this paper to cover this aspect of the subject, but variation in physical reaction to invasion must be kept in mind, such as a true cyst, condensing osteitis or a medullary infection with periostitis. We have, for instance, a cyst in the long bones, but rarely is there a direct portal for entrance except through trauma and metastasis, or, for instance, there is no such thing as a pulpless canal to conduct organisms into the cancellated structure of the humerus.

Recognition is based upon a knowledge of the structures involved and the main avenue through which vulnerability manifests itself. For example, cysts in the maxilla tend to proliferate in certain directions in definite locations. Cysts in the mandible do the same, but are governed by factors different from those that direct this extension in the maxilla. In certain parts where the periosteum is involved, the reaction will be different from that where there is no periosteum, as a cyst proliferating into the mandibular canal differs from one that produces periosteitis of the mandible. So, in the floor of the maxillary sinus, as far as the cyst formation is concerned, a different reaction takes place from that which occurs if it proliferates through the anterior palatine canal.

Thus, we see, recognition is based upon acquaintance with the behavior of these reactions in a given environment. There is a definite cycle which can be more or less clearly recognized in the gross formation of these circumscribing reactions. The process starts with a response to invasion. A thickening and enlarging of the reactive mechanism takes place. Later, obliteration of the cyst content, or rather a liquefaction, results. This occurs in various gradations from the cholesterol-like substance to a slightly oily straw-colored liquid. Just what this physiochemic process is we do not thoroughly understand, as there is no sharp demarcation in any of these stages. It will be noted that proliferation and extension are more pronounced in the end stage when the cyst wall is very thin and the content has reached the peak of its liquefaction. Our laboratory reports on the bacteriology indicate that a slow growing anaerobe is the activating organism in the later stage. The organism is found in the cyst wall; seldom or never in the cyst content.

Unless we appreciate the gradation, stage or cycles of evolution in these reactive mechanisms, it will be difficult to arrive at a proper recognition of this class of disease.

Roentgenology, of course, is the primary avenue through which the recognition of the cyst is approached, but the manifestation is the conspicuous factor that calls attention to their presence, about 8 per cent having local reaction only to indicate their presence, with no demonstrable manifestation, while 40 per cent are manifested in the form of low-grade infection, such as neuritis and myositis. There is little in the line of subjective or objective symptoms to distinguish the cysts from other pathologic entities having a focal or reflex potential for precipitating morbidity.

There seldom is any local evidence, only about 15 per cent having had clinical reaction as a local indication to suggest their presence, and in only 5 per

cent were these reactions acute. This leaves 85 per cent without any definite local symptoms. The outstanding thing about the study is that, with the exception of 15 per cent which showed evidence of local reaction, there was nothing except focal and reflex manifestation to indicate the presence of these cysts.

The symptoms, we find, aside from the local evidence sometimes present, are the same as in that class of cases having foci of infection in the oral cavity or adjacent structures as the cause for the symptoms. A few of these symptoms are of special significance, being the same, however, that you would find in gingival or periapical dental infection, infection from dental developmental defects, the tonsils or the associated sinuses. The symptoms which I find the most valuable in this connection are a characteristic ballooning of cellular tistue under the eyes, capillary sclerosis, adenopathy, which may or may not be present, pigmentation varying from red to purple in the edematous cellular tissue and the discoloration at the angles of the mouth. These signs must at all times be differentiated from the characteristic form and color peculiar to the patient. The edema under the eyes is not present in end-stage cysts unless, for some reason, the infection has become activated. My medical colleague, C. E. Ervin, has pointed out the fluctuating temperatures which are often characteristic of focal infections. There are many symptoms that may be recognized by the practiced eye which indicate pathologic processes of this character, but there are no distinctive symptoms peculiar to cystic intra-oral infection. The manifestation presents little that is distinctive, except that, in our series of purely uncomplicated intra-oral cystic infection, about 56 per cent of patients suffered from pain in the back and the lower extremities, while in the intra-oral cystic infection complicated by other focal infection, these lumbar region pains are present in about 40 per cent of patients. It must be realized that as far as the malady from which the patient suffers is concerned, there logically should be little to distinguish one form of focal infection from another; for it has been seen that practically all forms of foci have their origin in the cyst, or whatever name may be given to the circumscribing mechanism with which nature attempts to surround and arrest invasions.

A cystectomy may be any operation from the simple extraction of a tooth with a periapical infection or a gingival reaction, up to the enucleation of a cyst many times larger than the part from which it is removed. Extraction of teeth and cystectomy may be in fact one and the same operation, a cystectomy if the delimiting mechanism is removed with the cause that brought it into being. The removal of teeth without a cyst present is actually a dentectomy, and when a cyst, however small, is present, and is removed, it is a cystectomy. Over 37 per cent of our operative cases present these persisting areas of infection, nearly 50 per cent of these being present, with the causative factor absent. Some are most obscure and most difficult of interpretation, and have the faculty of proliferation and possibly of metastasis, thus extending themselves at times in the most remarkable manner. Until recently, I have felt that the greatest possibility for damage in this class of foci was associated with the maxillary sinus, but our investigations point toward the mandible as a more vulnerable portal for entrance. The focal aspect of this subject hinges on the fact that the invasion occurs as a periapical, gingival

or traumatic infection, the cyst wall being the actual focus of infection, because it is in this cyst wall that these latent or active organisms reside. This does not bar the fact that there may be, in some instances, an almost direct medullary invasion, especially in the vulnerable area of the mandible or the tuberosity of the maxilla.

From the foregoing, it will be seen that the infectious and toxic cycle should be practically the same, regardless of the origin, except as it is governed by the portals for distribution which the focal environment presents. The fact that these cysts have an infectious and toxic potential is very generally recognized, but the possibility for a reflex vicious cycle through pressure, extension or proliferation is not so well known. This is demonstrated by the fact that ear pain was eliminated in more than 14 per cent of the purely persisting radicular cysts, and that two cases of chorea were cured. Also, cases of referred ear pain in the study series where there were radicular cysts combined with other pathologic processes presented were only 3 per cent as against the 14 per cent in the purely cystic type, which indicates that direct pressure is the factor. This is reasonable to expect and the findings bear out such expectations.

It is a difficult matter to put a finger on certain aspects of this problem, as, for instance, to determine whether these delimiting mechanisms are ever sterile or whether they are always latent, or are intermittently or continually bombarding the bodily resistance mechanisms with toxins and organisms, or are, to some degree, by mechanical means, rendering the nervous system unstable.

It is a fact that these residual areas have a marked potentiality for producing certain disease cycles owing either to the selective faculty of the organism or to the pathways for distribution; by this, not a special disease such as myositis, but a tendency to produce a special disease, in the lumbar region is meant.

Without doubt, it is this aspect of the oral diagnostic field that must be given the most concern; for the proliferating and extending faculty that certain of these cysts have is remarkable, and it often taxes the capacity of the oral diagnostician to the limit to evaluate their significance. As I note the way in which residual areas extend themselves through the mandible and to other parts from the mandible, I often wonder if they do not have metastatic as well as infectious, toxic and mechanical significance. If the wart and mole are significant, I feel that these reactions have a possible significance in cell migrations, in certain stages in which it is very difficult to differentiate the malignant from the nonmalignant.

The faculty these cysts have for extending themselves from one side of the mandible to the other, thereby establishing a secondary rarefied area in a part where there is no local cause, is of so frequent occurrence that whenever I see one of these large, rarefied areas embracing the mandibular foramen on one side, I am not disappointed to find a like area on the opposite side. At times, the secondary manifestation will be more extensive than the source for the reaction. This secondary reaction may go so far as to become acute on the opposite side from its origin. The faculty which they have for establishing areas of infection in the symphysis of the chin, either by direct or indirect infection, further complicates this field. Their extension extramandibularly through the mental foramen occurs. Part of this problem is due to the varying degree of

cancellated bone found adjacent to the portal for entrance of the infecting organisms.

The surgical aspect of this work is carried out in keeping with the fundamentals peculiar to all surgery, with certain modifications which this special field suggests.

The first that commands out attention is the preparation of the field, it being understood, of course, that the approach to the operation is based upon certain clinical and physical preoperative preparation of the patient in a general way, as any other surgery demands. There are specific local complicating factors which have to be considered; that is, the infections that are peculiar to this field, especially those associated with the almost omnipresent subgingival infection found in this class of cases. Smear findings are the basis on which this problem it attacked. Smear findings determine how a given case will be handled. The smear findings are based upon three classes of infection, the spirillae, amebae and micro-organisms, chiefly the cocci. Distinctive treatment is instituted for each class of infection. This treatment is carried on long enough to assure a certain immunity and to afford at least a temporarily cleared field for operation. This is done to lessen postoperative sequelae.

The question of preoperative and postoperative care, which hinges on the requirements of the individual case, is important. If the preoperative treatment and the surgical technic is properly carried out, there will seldom be occasion for much postoperative care other than routine hospitalization, when necessary.

The approach to the operation is based upon the principle of facilitating the organization of the blood clot. The cyst wall, including the one osseous wall that best lends itself to the complete exposure of the cyst cavity is enucleated or removed, after which assistance is furnished to the organization of the blood clot by interrupting the blood supply at a strategical point or points where a circulation through the clot has the greatest possibility for becoming established. When it is necessary, this clot is reinforced with a flap introduced into the cyst cavity before suturing the periosteum and mucosa that have been reflected to furnish access to the field of operation.

This means that organization of the blood clot is promoted by severing vessels at close enough intervals to facilitate the conversion of the clot into tissue. The cut should not be made in the mucosa, but should be made in the periosteal surface of the tissue that has been reflected to expose the cyst cavity. This causes all of the larger expanse of the incision to open on the cyst side and prevents the exposure of the cut surface to the oral contacts. When it is required, a flap is made from the reflected periosteal mucosa. This is frequently necessary in extensive involvement of the mandible.

The subperiosteal is the incision of choice when mere interruption of the blood supply is used for producing a flow of blood into the operated cyst cavity from vessels that have been severed at a strategical point within the field of operation. The outcome is excellent as far as local surgery is concerned. At most, there may be a partial breakdown in a few cases. These can be readily handled by irrigation and restimulating the formation of the blod clot into tissue.

The prognosis depends on the nature of the malady from which the patient suffers. When the cyst is in the end stage, the result is speculative, or the recovery will be slow, as such patients do

not fall into our hands until much of the damage is beyond repair. This has been especially true in ocular involvement and in certain cardiac lesions. When an intra-oral cystectomy is performed for early or midstage cysts, the prognosis is very favorable provided all other foci of infection have been eliminated. It is indeed gratifying to see how spectacular many of the results are.

SUMMARY

Most intra-oral cysts are the vulnerable barrier erected in response to infectious invasion, developmental defects or trauma.

They have a remarkable faculty for persistence, extension, proliferation and possibly malignancy, either primary or secondary.

They have a definite cycle of evolution with the end-stage practically identical, regardless of source or dimensions.

Recognition is based upon symptomatology and manifestation, with surgical and laboratory technic to verify roentgenographic findings.

Intra-oral cysts are significant as potential foci of infection, as a source for toxins and for disturbances of a reflex nature, largely mechanical in character.

There is a definite local preparation for surgery based upon the recognition of distinct classes of subgingival infections, chief of which are spirillae, amebae and cocci.

The surgery is based upon complete exposure and enucleation together with due provision for the interruption of the blood supply at strategical points to promote organization of the blood clot and, where necessary, providing a flap to facilitate this organization of the blood into obliterating tissue.

DISCUSSION

*E. L. Aison, Chicago, Ill.:* The subject of intra-oral cystectomy embraces a wider field than that treated by Dr. Vastine in his paper unless he intended to discuss certain types of this pathologic process only. Under this title must of necessity be considered the two groups of cystic involvement affecting the oral tissues: 1. The cysts of the soft structures, such as the mucous cysts, the ranulae and the cysts of the salivary glands. 2. The cysts found about the dental and associated osseous structures, namely, the root or periosteal cysts, the dentigerous or follicular cysts, the cysts of the maxillary sinuses and the adamantinomas. Each one of these has its peculiar and characteristic clinical features. And although the subject has been well covered in the past, a newer thought on diagnosis, a better and more refined technic of treatment will no doubt prove a valuable contribution to dental and surgical literature. The term intra-oral cystectomy I believe to be an appropriate addition to our nomenclature. Dr. Vastine's reference to the local and systemic reactions associated with these cysts is especially noteworthy. It is a well-known fact that these lesions develop and exist over a period of many years without causing any pain until acute inflammatory reactions, pressure on a nerve by the cystic contents or secondary infections take place. In my experience in a large hospital clinic, cysts in the oral cavity alone are rarely associated with the serious systemic diseases such as arthritis, the grave cardiovascular, metabolic, renal, gastric, nervous, eye and respiratory diseases or the acute and chronic blood dyscrasias, such as are commonly traceable to pyorrhea or other chronic infections about the teeth and investing structures, the tonsils and paranasal sinuses. This is no doubt due to the presence of the dense fibrous connective tissue membrane, which, although formed as a result of reaction to local irritation and cell proliferation, also serves at the same time as a protective wall against systemic invasion. In this as well as in other oral foci, the degree of reaction depends on the virulence of the micro-organisms and toxins involved, and the patient's age and tolerance to infection. There is no more interesting nor more important chapter in the entire realm of medicine than the elusive cancer problem. In spite of the many theories that are advanced and the vast amount of experimental research that has been devoted to the study of new growths, we have not been able to fathom this great

enigma, and today the etiology of malignancy continues to be as much a mystery as ever. The mechanism of cell differentiation and cell multiplication appears to hold the key to the problem. Whether this stimulus to cell multiplication in acute infection, tumor formation and normal cell growth is similar has not as yet been demonstrated. Studies in biochemistry and especially of physical chemistry on the biology of the cells are destined to play the important rôle in explaining malignancy in the future. However, while cell degeneration and new growth formation is possible in connection with these cysts, especially the follicular and adamantinoma type, past clinical experience shows that development of malignancy in these conditions is very unusual. I agree with Dr. Vastine that the irradication of acute mouth infections prior to operation for the removal of cyst is very necessary if post-operative complications are to be avoided, especially Vincent's stomatitis. And I would add that the same caution should be practiced in the removal of teeth, impacted or not impacted. Good circulation to the parts involved, blood clot organization and healing following complete cyst enucleation or treatment by the Partsch method when indicated was never a problem in my experience. Scarification of the bone cavity by gentle curettage to promote granulation and suturing of the flap always prove sufficient.

*Dr. Vastine (closing):* I thank Dr. Aison for pointing out the intra-oral cysts other than this paper presents. This omission, as well as that of historical background, was with the object of devoting the allotted time to discussing those cysts having origin in intra-osseous reactions, the special purpose being to emphasize the end-stage of these cysts, which is rarely recognized. The serious systemic diseases which Dr. Aison has failed to associate with these intra-oral cysts are seldom or never present in the mid-stage when the cyst wall is dense enough to lend itself to enucleation. In the end-stage, the delimiting membrane is largely obliterated, thus contributing toward making end-stage cysts obscure, and difficult to demonstrate except by surgical exploration. This is markedly true in the vulnerable area of the mandible. It is in this end-stage of the cyst that we find associated the more serious secondary manifestations regardless of whether these cysts are of follicular, periapical or gingival origin. In certain intra-oral cystectomies, if proper attention is given to facilitating the organization of the blood clot, a much more prompt and satisfactory result can be obtained. This is best accomplished by interrupting the blood supply by way of the periosteal mucosa.

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# *Editorials*

## CHRISTMAS AND THE SEALS

Each year, an appeal goes out from the American Dental Association to its members in the form of Christmas seals to augment its relief fund. In this way, an appreciable amount is added to the fund without in any way burdening the individual members. Nearly every one can spare a dollar, and if every one did, it would not be long before the sum would be large enough that the interest thereon would provide sufficient funds to render aid to all of our needy members. As the years go on, a larger and still larger number will require aid; therefore, provision should be made for this increase.

There seems to be a misconception in some quarters concerning the seals. At the 1923 meeting, when the dues were raised, it was suggested that these dues be prorated and a certain amount be allotted to relief. When this was done, an impression went

out among some of the members that the seals were to be discontinued, but this was never the intent of the Relief Commission or the Association Officers. In any event, at the 1924 meeting, a resolution was passed which provided that the income from dues should go into a general fund and be budgeted out to the various departments, which at once did away with the plan of diverting part of the dues to the relief fund. Therefore, the provision of the 1923 meeting was never carried out, and no part of the dues was ever put separately into the relief fund.

The provision not to use any of the principal for relief was a very wise one, because an unexpected emergency might arise at any time and deplete the fund in a very short time. Therefore, in view of the fact that only the interest is being used, it behooves the members to raise the fund as rapidly as possible, to the end that the interest may meet the increased calls on the Relief Commission.

The response to the sale of Christmas seals has been most gratifying, but a canvas of the states reveals the fact that there is an inequality in certain states in the relation between the contributions to the fund and the benefits meted out to the needy members in those states. In one state, during the past three years, the sum received by the members has been more than double the total amount coming from that state through the sale of seals. Manifestly, if this were true of all the states, our fund would not grow with very encouraging rapidity, nor would we eventually be able to render adequate service to the actual needy in every state. As has just been intimated, we must make provision for an increasing amount of interest to provide for the increasing need which is sure to come.

It would be well if all those who are abundantly able to pay would increase their contributions to compensate for the ones who cannot pay; for we find a certain number who, for one reason or another, are unable to remit for the seals. Every year after the seals are sent out, some pathetic letters are received giving reasons for not remitting. For instance, one man writes that he has been without income for four months, and one can imagine what that means. Another states that he is so pressed to meet

his actual necessities that he cannot spare even the dollar. It should be understood that it is not the wish of the Officers or of the Relief Commission to work a hardship on any of our members, but there are relatively few in the profession who cannot send a dollar. Some want to know how the fund is administered, and when this is explained, they usually remit their quota. Here is a letter from one man: "We have plenty of charity right here at home—therefore am returning your stamps. I believe charity begins at home, and there are calls every day." Yes, we know that there are calls every day, and we also know what is said about charity beginning at home. We can imagine just the frame of mind a man is in when the appeals for help pile up so high that he can hardly see over them, but we have learned this, that by looking over that pile of appeals and seeing the happiness that comes from responding to them, a double benefit will be found and a manifold reward. No man living was ever made so happy by receiving a benefit as he was by bestowing one on others, and the kind of happiness that comes from giving is of a higher order than that from any other source. Then, there is another aspect of this particular case. Is the man who is responding to "calls every day" contributing to a single activity in the vicinity of his home that will in turn help to look after him in case of old age or incapacity? There has never been in any profession a movement with which we are familiar that has meted out to needy members such a large measure of return as has the relief fund of the American Dental Association, and with added resources, it is capable of doing more in the future than in the past.

But read this: "Enclosed herewith find check for one dollar, on account of the seals. It has been a pleasure in the past to help in this small way to support the worthy cause. I am obliged myself to discontinue practice on account of approaching blindness." Think of the spirit behind that donation! Can any one imagine that if that dear brother dentist of ours should ever chance to need help from the relief fund, there would not be in the hearts, not only of the Officers and the Relief Commission but also of every member who has contributed to the fund,

a throb of happiness that they had helped to make provision for the care of such a man?

We have referred briefly to the tangible benefits to be derived from the seals, but great as these are, they cannot be compared with the real value that comes to our Association from this enterprise. There is no single agency that binds our members so intimately together in a common purpose and in universal sympathy and affection as the sentiment created by the seals. At this beautiful time of Christmas, when the hearts of men expand in a common brotherhood, the seals act as a medium whereby each member may reach out his hand and touch that of every other comrade in the ranks, and the sum total of the good will created in this way is of immensely greater value than can be estimated in mere dollars and cents. Let us make the response this year as nearly one hundred per cent as possible, and thus not only add materially to the fund but also create a degree of happiness among our members that can be achieved in no other way.

And meanwhile—a Merry Christmas to all!

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## THE YOUNG PRACTITIONER

Too often, we forget, in the absorption of our affairs, that we have a distinct duty to the young men and women who are entering the profession. Too often, we fail to extend to them the right hand of fellowship in a way that makes them at once feel at home in our midst. It is not altogether our fault that this is so: it is due more to oversight than to wilful neglect of duty. In our dental societies, we are so busy that we too frequently overlook the fact that the new recruits are needed even as much as the long time members, and we do not quickly enough make a place for them by the side of the old guard.

A young man coming into a society for the first time has a sense of being in a strange environment, and he needs encouragement. If he is made acquainted with some of the older members—men of whom he has probably heard—he at once feels at home and he

readily forms the habit of attending the meetings, but if no one pays any attention to him, it does not take very long for him to find himself out of his element, and the strangeness grows till he drops out and falls by the professional wayside.

It is axiomatic that in order to keep the interest in dental society work up to concert pitch, it is necessary to be constantly introducing fresh blood. To carry on any organization year after year on the same old plan without the infusion of new ideas is to invite lethargy and ultimate stagnation. Few men who have been long associated in an intimate way with an organization are sufficiently intuitive to see the limitations which inevitably creep in unless there is a constant readjustment of ideas to keep abreast with the times. There is no assurance that the policies of today, successful though they may be, will fit into the requirements of tomorrow. If there is one thing certain in our modern civilization, it is that change is the order of the day, and no individual or organization can afford to stand still and be content with past or present achievement.

For this very reason, if for no other, our dental societies need the constant influx of new members; and the society that does not acquire new members soon begins to deteriorate. It should always be remembered that the men who today are the bone and sinew of our present splendid and vigorous dental organizations were, a very short time ago, among the young and inexperienced members. They all had to be assimilated into the societies by the slow process of mere personal acquaintanceship with a few members, and this gradually extended into a wider and wider familiarity, not only with the personnel but also with the problems of the organization, till, by very force of their adaptability and interest, they finally became an intimate and integral part of the society. No man ever jumped to immediate prominence in any dental organization. There are no "cross of gold" incidents in dentistry—only the slow and often discouraging developments which are marked all along the way with painstaking effort and devotion to cherished ideals. The young practitioner should not be disheartened if his way to prominence seems terribly slow. Slow growth is, after all, the

most certain growth, and if the footing seems difficult, the goal will be all the more secure when it is reached. Real conscientious effort on the part of our new members seldom goes unrewarded for any length of time, and this is the lesson that our young practitioners must learn.

But, in this connection, there is also a lesson for the older members. We cannot expect the recent recruits to go on indefinitely and retain their enthusiasm about attending dental societies unless we give them some encouragement. A kindly word and a bit of counsel volunteered to a young man in the beginning of his membership may make all the difference between an enthusiastic and interested co-worker and a hopeless backslider. "No man ever died of too much encouragement," and no young man was ever seriously injured by it in the early days of his professional career. Oversight and neglect—for the most part thoughtless neglect—on the part of older men may be charged with keeping many a young dentist from coming quickly into his own, and while no really worthy man is ever thereby permanently deterred from achieving his ultimate purpose, it still remains that encouragement is an asset to a young man and neglect is a detriment.

Let us welcome our young practitioners into our ranks; and when we get them there, let us keep them by taking an interest in their welfare and making them feel that they are really a part of this great organized profession.

## DEATHS FROM THE USE OF LOCAL ANESTHETICS

The use of local anesthetics is an operation so common in the clinical practice of dentistry that many operators are sometimes prone to use them without considering the dangers inherent in them when not properly used. In this connection, reference to the interesting study of the "Toxic Effects Following the Use of Local Anesthetics"[1] made by a Committee of the American

1. J.A.M.A., 82:875-876 (March 15) 1924; 90:1290-1291 (April 21) 1928.

Medical Association is both timely and interesting. The report had created such a large measure of interest at the time of its publication that it has since been found desirable to reprint it in pamphlet form. This report will bear close study on the part of those who are constantly using "local anesthetics." In a fashion, the application of local anesthetics has long been considered a province peculiar to dentistry, and much of sound clinical value should come from that source.

While the report mentioned above has been made by a committee of physicians, the broad findings are pertinent to a better understanding of the application of local anesthetics on the part of the dental profession. Certain of the broad conclusions made from a study of forty-three deaths caused by local anesthetics may be mentioned as having an indirect but important bearing on the administration of these agents by the dental operator:

1. Such accidents are more frequent than commonly supposed.
2. Accidents occur with the more recently introduced synthetic anesthetics as well as with the older agents, and the symptomatology is very similar in all.
3. Unexplained differences of susceptibility probably exist, but the committee believes that the observations of the concentrations recommended will reduce the risks very materially, if not altogether.
4. The reporting of such accidents is a duty which the physician owes to others as well as to himself; to others because the study of such information is at present the only means by which accidents may be reduced, to himself, because the prompt report of the facts to a confidential professional committee is one of the best means of guarding against unjustified suits for malpractice.

The study of deaths and injuries following the use of local anesthetics has again taken on a refreshed, though none the less interesting, aspect through the initiative of the *British Dental Surgeon,* which offers its facilities as a clearing house to collect all possible data on deaths of persons caused by the administration of an anesthetic for dental purposes. Their findings will be awaited with interest. On account of the differences in dental procedure and preparations used here and abroad, the formation of a committee acting for the dental profession through the American Dental Association to study the toxic effects following the use of local anesthetics in dentistry should render a signal service to the profession in so important a field as the one under

discussion. This body having in its membership representatives of the different branches of dentistry should find a ready and intelligent response on the part of the profession who have ever shown a willingness to act in the best interests of their branch of the healing art.

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## SAY NOTHING

The most eloquent speech of all is sometimes no speech at all. To suffer abuse and senseless criticism and say nothing is to disarm your accuser and leave him limp and helpless. Silence is golden, and words are wasted when there is no occasion to use them. They are worse than wasted when they are employed to convey anger, censure, abuse or contumely. If you cannot speak well of an individual, say nothing. Sometimes it is hard to keep quiet in the face of unjust imputation, sometimes the old Adam in us rises and impels us to answer back in kind, but the really great man never loses his equanimity—he smiles serenely and says nothing. And thereby he conquers. All the bluster, and fussing, and fuming, and tempestuous declaiming imaginable will never carry the weight of dignified silence. Say nothing and win.

# BUREAU OF CHEMISTRY

## SEMAFOR

### A Wig Wag System of Oral Hygiene

RECENTLY, there has been introduced to both the dental and the medical profession another addition to the evergrowing list of dentifrices and mouth washes: "Semafor" (The Indicator Laboratories, 154 E. Erie St., Chicago, Ill.) In order, apparently, that there might be no mistake about the meaning of the name, there appears in illustrated form on the carton a white gowned individual presumably wig-wagging with red and white flags; the red flag signaling normal mouth conditions, the white flag signaling excessive acidity.

According to a booklet accompanying the liquid:

> Semafor Mouth Wash is a scientifically compounded alkaline liquid, originated and developed by Dr. Alfred H. Kropff, B.S., M.A., Ph.D., a chemist of rare skill and a recognized authority on purifiers.

As far as our records go, Dr. A. H. Kropff does not seem to be generally recognized as an outstanding chemist of rare skill. The name of Alfred H. Kropff appears but once in the author indices of Chemical Abstracts for the past ten-year period; which would seem to indicate that he has contributed little to current scientific chemical literature. A Dr. A. H. Kropff received the degree of Ph.D. from Columbia University in 1909.

Semafor is purported to be even more than "a scientifically compounded alkaline liquid." According to a letter enclosed in the trade package, it is a new departure, for Semafor "combines psychology with therapeutics in a practical way. . . ."

The chief selling point of the product appears to be that Semafor is "Visible Mouth Hygiene—a new contribution to Health." "Semafor Signals Safety and Danger by Color Changes in the Mouth."

#### HOW SEMAFOR ORIGINATED

Among the wares of vendors of proprietary remedies is the capitalization, if possible, of some unusual explanation of the genesis of the discovery. Semafor appears to be no exception. If one is to believe the advertising, Semafor is the result of "research work in mouth hygiene." We are told:

> During the World War Dr. Kropff supplied the United States Government with about 400,000,000 tubes of water purifier. Later on, because of his experience in the field of hygiene, Dr. Kropff was called upon by an eminent dentist to undertake research in mouth hygiene. The object of this research was to develop a safe and harmless, yet efficient agent that would purify the oral cavity, neutralize excess acids and at the same time indicate the condition by changing colors. This led to the development of Semafor, which has completely revolutionized old methods of mouth hygiene.

On examining the evidence, one wonders what part Dr. Kropff played in developing the product. Letters Patent No. 1112180, which is the same number printed on the Semafor label, was issued Sept. 29, 1914, to one Charles W. Westenfelter of Springfield, Ohio. Nowhere in the letters patent does the name of Alfred H. Kropff appear, either as co-patentee or as assignee. Incidentally, it is interesting to note that the letter patent was issued long before the entrance of this country into the World War and long before "Dr. Kropff supplied the United States Government with 400,000,000 tubes of water purifier." It would follow, then, that "Semafor" was developed even before "Dr. Kropff was called upon by an eminent dentist to undertake research work in mouth hygiene," which "led to the development of Semafor. . . ."

*Acid Causes Decay—Semafor Destroys Acid*

VISIBLE MOUTH HYGIENE

*The Scientific Method made possible by*

Semafor

*Antiseptic Solution*

SIGNALS SAFETY AND DANGER BY COLOR CHANGES IN THE MOUTH

You used good judgment when you bought this bottle of Semafor Mouth Wash. Now, read this folder and learn what Semafor will do for you. Always insist that your dealer give you Semafor Mouth Wash, and use no other.

Copyright 1927
INDICATOR LABORATORIES, Inc., 154 East Erie St., Chicago, Ill., U. S. A.

Front cover of pamphlet advertising Semafor.

MODUS OPERANDI OF SEMAFOR

Apparently, the high point in the Semafor propaganda is the play on a "wig-wag" system of oral hygiene. The Semafor concern provides two sets of propaganda with each trade package—one set for the laity and another set, ostensibly, for the profession. To quote from the latter:

> SEMAFOR, a red liquid, *by changing white or by retaining its color* reveals when acids are present in the throat and mouth. While an *acid condition is present* from any cause, and this includes inflammation and infection, SEMAFOR will decolorize and be expectorated white. As the *degree of acidity is diminished,* SEMAFOR is expectorated pink. When SEMAFOR has *neutralized all of the acids present* at that rinsing or gargle-period, it is expectorated red—in other words, there is no change in color—showing that SEMAFOR has done all that any antiseptic can do at the time. It indicates the degree of acidity present by the number of gargles and rinses required to restore the red color.

So here is seemingly a new type of dentifrice—a chameleon dentifrice—and how unscientific. What would be the reaction of the modern dentist when his patient informs him that "my acidity is two gargles of Semafor"?

For the laity, there are other directions. Here, it seems that the wig-wag scheme goes farther with the block system of "safety and danger by color changes in the mouth"—indicated by white and red flags—white for "unclean or acid condition," red for "normal and clean" condition. Whatever the colors indicate, the signal is to use more Semafor.

FURTHER DENTAL AND MEDICAL CLAIMS

In addition to the "sales talk" of research in oral hygiene, there is the following:

BLEEDING OR SOFT GUMS—It inhibits germ growth and activity, checks fermentation of food particles, hardens and restores color to the gums.

TONSILITIS AND ORDINARY SORE THROAT. The relative severity of the condition will be indicated by the number of gargles required until pink returns.

HEAD COLDS AND CATARRH.

DECAYED TEETH—Semafor will destroy the unpleasant odors that result from decayed or bad teeth.

DENTIFRICE — Semafor polishes and whitens the teeth.

Even halitosis, that now worn-out advertising word, is not overlooked.

From a circular letter addressed "Dear Doctor," we quote:

SEMAFOR will be found efficacious wherever an alkaline antiseptic is indicated to cleanse and heal inflamed, irritated mucous membranes. It is also indicated in cases of Systemic Acidosis, particularly during pregnancy, and in various mouth conditions such as Gingivitis, Vincent's Angina (Trench Mouth), Stomatitis, etc. It is a soothing and effective nasal spray.

In order that the dental profession and the public might have some idea of this so-called scientific and economical mouth wash, the product was referred to the A. D. A. Chemist for investigation.

A. D. A. CHEMIST'S REPORT

"One (1) original package of Semafor Antiseptic Solution, price, $1.00 (Indicator Laboratories, Inc., 154 East Erie Street, Chicago, Ill.), was purchased on the open market for examination. The carton bore the following:

SEMAFOR antiseptic solution signals safety and danger by color changes in the mouth.

Alcohol 25 per cent. Contains sodium chloride and sodium carbonate in combination with thymol, menthol and other ingredients. Patent 1112180. Other patents pending.

For correct color change do not use full strength but measure accurately.

Semafor makes nine times its volume of mouth wash.

Into one-half glass of water (about 4 ounces) pour one tablespoonful of Semafor. To insure accuracy of measurement use the measuring cup furnished with each bottle. This cup filled to bottom of ring (not full) equals one tablespoonful.

Rinse and flush mouth for 20 seconds or more, then expectorate the waste. Your mouth condition is revealed by the color of the expectorated waste.

"Enclosed in the carton was a bottle, a small paper cup, a booklet describing the origin and uses of Semafor and a circular letter addressed 'Dear Doctor.'

"The bottle of Semafor contained 344 cubic centimeters (approximately 11½ ounces) of a clear, red liquid, possessing an odor of aromatic oils and a saline taste. The specific gravity of the liquid at 25 C. was 1.014. It possessed an alkaline reaction—when measured against a hydrogen electrode, it was found to have a $p_H$ of 9.7. On addition of acid, it was decolorized, which indicated the presence of an indicator, such as phenolphthalein.

"Qualitative tests indicated the presence of chlorids, sulphates, carbonate, sodium, phenolphthalein and alcohol. Phosphates, borates, oxalates, salicylates, glycerin and other metals were not found.[1]

1. The details of analysis will be published elsewhere.

"Quantitative determinations yielded the following:

| | |
|---|---|
| Total solids | 6.53% |
| Sodium ($Na^+$) | 2.33% |
| Carbonate ($CO_3^{--}$) | 0.09% |
| Bicarbonate ($HCO_3^-$) | 0.06% |
| Chlorid ($Cl^-$) | 3.41% |
| Sulphate ($SO_4^{--}$) | 0.03% |
| Alcohol (by volume) | 20.79% |
| Phenolphthalein | 0.01% |

"Calculating from the foregoing, each 100 cubic centimeters of Semafor would contain:

| | |
|---|---|
| Sodium chlorid ($NaCl$) | 5.71 gm. |
| Sodium carbonate ($Na_2CO_3$) | 0.16 gm. |
| Sodium bicarbonate ($NaHCO_3$) | 0.08 gm. |
| Sodium sulphate ($Na_2SO_4$) | 0.04 gm. |
| Phenolphthalein | 0.01 gm. |
| Alcohol | 20.79 c. c. |

"From the foregoing, a solution having the essential properties of Semafor contained in the trade bottle may be made by dissolving sodium chlorid, 20 gm.; sodium carbonate U. S. P., 0.7 gm.; sodium sulphate U. S. P., 0.3 gm.; alcohol (95%), 75 c.c.; adding water to make 350 cubic centimeters and phenolphthalein, 0.03 gm., to give the red color, and a small amount of essential oils.

"Each dose, when measured as directed for use as a mouth wash or gargle, that is, one cupful (17 c.c.) dissolved in half a glass of water (120 c.c.), may be calculated to contain: 0.97 gm. sodium chlorid; 0.04 gm. sodium carbonate; 0.007 gm. sodium sulphate; 0.0017 gm. phenolphthalein and 3.5 c.c. alcohol. Expressed in percentage on the basis of 120 c.c. for one-half glass of water and 17 c.c. Semafor, each dose would therefore be: sodium chlorid, 0.70 per cent; sodium carbonate, 0.02 per cent; sodium bicarbonate, 0.01 per cent; sodium sulphate, 0.005 per cent; phenolphthalein, 0.001 per cent, and alcohol, 2.5 per cent.

"A few mouth-rinsing tests with Semafor, according to the given directions, yielded results which were not concordant, either to 'acidity' or 'normal condition' of the mouth. If one casually took a generous portion of Semafor, the expectorant indicated a 'normal and clean mouth'; if one took a small portion of Semafor, the expectorant indicated an 'unclean or acid condition.' Furthermore, the statement that Semafor 'reveals relative degree of acidity' is inaccurate and misleading."

So, this "scientifically compounded alkaline liquid" is shown to be nothing more than a simple saline solution to which a little alcohol, sodium carbonate and an indicator in the form of phenolphthalein have been added. The product, it is indicated, is covered by a patent, which, as is well recognized, means little until after the claims have been passed on by the courts. The opinion is ventured that the patent claims for this dental preparation would not stand the test of originality—as far as modern biochemistry is concerned. It has been demonstrated that the reaction of the saliva is normally slightly acid, and that mouth acidity or alkalinity cannot be controlled by mouth washes and the like.

Semafor is advertised as the economical mouth wash. The claim is made: "Now at last there is a mouth wash that is economical to use." A simple calculation will show the length to which the advertisers of Semafor go. Each bottle containing 344 cubic centimeters sells for

one dollar. Each cupful when measured as recommended holds approximately 17 cubic centimeters. Thus, there are 20 cupfuls in a bottle. Each dilution, when used according to directions, would thus cost 5 cents, and when used twice daily would cost 10 cents per day; or $1.00 for ten days. Simple arithmetic thus contradicts the claims that Semafor is "economical to use."

The modern dentist, recognizing the lack of scientific merit, will not allow himself to be deceived by a preparation devoid of any great virtue, masquerading under a fanciful name and exploited by means of exaggerated unproved claims. The public must be made to appreciate that psychologic appeal by such simple expedients as color tricks, without therapeutic soundness, does not cure disease.

# BUREAU OF DENTAL HEALTH EDUCATION

## THE MAINE MOUTH HYGIENE PROGRAM*

By DOROTHY BRYANT, D.H., Augusta, Maine†

SINCE accepting the invitation to speak on the Maine mouth hygiene program, I have asked myself by what right I am to impose on you an account of our activities. They are not very different from those of any other state program: we have merely selected from the other programs the features that seemed adaptable to our circumstances.

To understand our program, it is necessary to know something about Maine. Located in the extreme northeastern corner of the United States, we are the largest of the New England states, nearly as large as all the other New England states together. The most southern section of Maine is more or less devoted to industrial interests; the central and western sections, to farming; the north, to potato raising. The northwestern section is made up entirely of unsettled forests devoted to lumbering. Maine has an area of 33,040 square miles; a population of 768,014, an average of 25.7 persons per square mile, ranking thirty-fifth in population in the United States, with the population concentrated in the southern third of the state and along our 2,400 miles of seacoast. Our huge area and small population make Maine almost entirely a rural state.

The Maine State Department of Health, the legal authoritative health organization, has been active in dental matters for several years. Prior to the development of an active dental hygiene division, interest in dental health had been manifested by the appointment of a dentist to the public health council, an advisory group to the state commissioner of health. With the creation of our dental hygiene division, a little more than four years ago, it became necessary to form a definite program.

We commenced our program with these two ideas in mind: first, that we would use every reasonable method within our means to develop general interest and spread information concerning dental health throughout the state; secondly, that we would attempt the organization of dental health services, and try to influence the already functioning dental clinics to see the need of broader service. We felt that these two projects fitted into the general scheme of any state health department, and might bring us to our goal—to have every one so appreciative of the value of their teeth that they will take care of

†Director, Division of Dental Hygiene, Maine State Department of Health.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 22, 1928.

them without urging from us or any one else.

Our advisory or consulting service, as we call it, having to do with the dental clinics and creation of new services, is at the call of any community officials, community nurses or health or welfare organizations who desire either to better their present dental programs or to create new ones. The assistance that we give naturally varies to fit the community or organization, because, as you can well recognize, no two are identical. But, as a general rule, we advise all communities or organizations to adopt an educational program. In that recommendation, we have met many obstacles, perhaps the principal being the public opinion of the lay person and the behind-the-times official that what is needed more than anything else is a free dental clinic where the older school children can have their teeth fixed. We have had that idea to combat in almost every instance, and, in some places, it has seemed best to yield a little, using the desired operative dental clinic as a temporary step to our educational program.

In the very few communities where there is a real need of clinical service, we have adopted and urged these fundamentals as the reasonable procedure:

1. That the clinical work be limited to the children of families too poor to secure dental care for themselves.

2. That the work be limited to caring for only the youngest children, none above the fourth grade at the most, and preferably none above the second grade.

3. That the operative dentistry be limited to the removal of infectious deciduous teeth, the filling of the first permanent molars and prophylaxis. In this, we advocate that particular attention be given to the permanent filling of all fissures that show any indication whatsoever of decay. This may seem extreme, but so many clinic patients become "lost" that extreme measures are justifiable.

4. That each patient pay something, however small, for his or her treatment.

5. That an effort be made to recall each patient at least every six months, and the children of kindergarten age, every four months.

Maine, unless she changes a very great deal, will never have many bona fide dental clinics. Our communities are too small. We have only twenty cities, one of which has a population of about 70,000, eight of more than 10,000, and the others are scarcely large enough to be considered cities at all. With 494 organized communities and 174 unorganized territories, and only 432 dentists located in ninety-seven communities, transportation enters into our dental problems in a way which we have not yet solved. Some of our communities are from 40 to 50 miles from the nearest dentist. If we were a southern or middle state without climate to consider, distance would not constitute a difficulty; but, in some sections of our state, automobile transportation can be depended on only between June and November, and those are the months when the people in the outer sections are the busiest making a living. So it remains for us to find a means of sending dental service to them. Our limited finances have prevented that activity.

Realizing that our best results will eventually come from working with the present school children, the greatest part of the educational section of our program has been either directly or indirectly with them. Because we have not had a large force of dental health workers to carry instruction to the children in the classroom at regular and frequent intervals,

we have concerned ourselves to some extent with the present and prospective school teachers. This has been slow in producing results, for the school authorities have had to be more or less "worked up" to seeing the need for dental health education. Practically 65 per cent of the schools in Maine are rural—of the one-room type where the teacher has enrolled from eight to forty-eight children in all eight grades. The teacher in such a situation has her hands full with teaching the regular course without having dental health added to it. Consequently, we were required to move slowly with this vital group, but, last year, practically all of us did something in health work, and dental health predominated. Each year, our state department of education outlines a particular project to be emphasized throughout the year. This coming school year it is to be "health"; so we look for even better results.

Early in our dealings with the teachers, we found that they knew little about teeth, except that they should be brushed. As that constitutes but a minute part of dental hygiene, it has been necessary to educate the teacher as well as the child. We have used the regular channels for this: the normal schools, both regular and summer sessions; the teachers' conventions, county, district and state, and the mails. Unfortunately, we have not had entrance to all state normal schools; but that will be remedied this next year, we hope. For the convenience and use of teachers, we have prepared a booklet of outlined lessons on dental hygiene, a collection of stories and other items. We keep a large supply of posters that teachers are permitted to borrow, and we are constantly devising new ideas for contests and the like.

We base all our education, whether of children, teachers, other adults or any other group, on one text; that is, that good teeth result from four things: proper food, thorough mastication, daily care and regular visits to the dentist, adapting instruction to the situation as it arises. To stress these points, the moving pictures used in our portable machines have proved themselves very valuable, especially in those districts where moving pictures are a rarity; and we have districts of that type.

From the first, we have advocated mouth examinations, to be made in a careful manner, at regular intervals of one year, by some one skilled in detecting the very beginning of decay. In as many instances as possible, this is done by the local dentists very satisfactorily, and the follow-up program is carried out by the school nurses, physical directors or teachers. It is, of course, the follow-up work which brings results. Our personnel does not permit of that work, at present. In several places where dentists are not available, we are making the examinations with the understanding that, as soon as possible, the work will be taken over by a local worker. This is resulting in the school departments' importing a dentist for the purpose.

Naturally, no dental examination is of any value to the patient unless the discovered conditions are explained, and some follow-up system is carried out. The person making the examinations is asked to tell the child pleasantly the condition of his mouth as to cleanliness and the number of decayed teeth, and we ask that written notice of the conditions be sent to the parents. Because children are apt to mislay or lose notices of this sort, all of our state forms for this purpose must be signed by the child's parents, and returned to the teacher.

This gives us a dependable means of check-up. We like all examinations to be made with mouth mirrors and explorers, and we do not like any mention to be made, even by an examining dentist, as to what teeth need extraction or filling. We feel that diagnosis of that detail is the right of the child's family dentist or clinical operator. We are trying, as far as possible, to do away with the chart's being sent to the parent, using just a notice instead, although we still have some who prefer the chart type of notification.

The conditions revealed by dental examinations in various towns differ in accordance with the extent of other health activities. In places where there is a well organized school health program, and they are few and far between in Maine, the dental corrections are naturally more numerous than in communities without such service. There is no doubt that a school nursing program effects many corrections, but the school nurse or school physician who makes a complete or reasonably adequate mouth examination is a rarity. Hence, our insistence on a dentist or capable dental hygienist for this work. That is one feature of our program for this next year: the examination of every kindergarten and first and second grade child by a dentist or dental hygienist. The corrections we will urge where dental work is attainable, but, in the remote districts, we do not feel justified in demanding corrections.

Between last December and July, our division has itself examined 3,920 school children, of whom 22.73 per cent had clean mouths and 81.74 per cent, decayed teeth, with an average of 3.1 cavities per mouth. We regret that to follow up these cases was impossible. That had to be left to the local individuals; but reports from them indicate that corrections were numerous, although accurate statistics are not available.

Like so many others, we have instituted the 100 per cent correction plan with mouth hygiene certificates for the individuals, and honor rolls for the classroom. This method has been particularly successful.

As other means of circulating general information, we use the radio and newspapers; take advantage of every possible opportunity to meet women's clubs, parent-teacher associations, service clubs, etc., and present exhibits at county fairs and the like. We are more interested in adults as parents than as adults; but we do not miss an opportunity to emphasize the value of dental health for their own sakes.

As yet, we have not mentioned dental health education services or dental hygienists. We have at present only two communities employing this type of service. It has been difficult to create a demand for this service; but, commencing in September of this year, through the activities of several American Red Cross chapters, an itinerant dental hygienist is to work for varying periods in five places. We expect this work to be more or less of a demonstration, resulting in the initiation of several services of similar type, for towns in the same school districts. This type of service seems the most effective basis for development in Maine. The county unit is generally impractical, for our large state is divided into just sixteen counties, only four of which are small enough to be used as units. The others are much larger, Aroostook County being larger than the states of Rhode Island and Connecticut combined.

Maine has one situation which, to my knowledge, is unique. Our 2,400 miles

of seacoast comprise many harbors of good size and innumerable smaller bays. In these harbors, and also outside them, are countless islands, some of them 20 or 25 miles from the mainland. The majority of these islands, especially the larger ones, are inhabited by lobster fishermen and their families. The number of families on each island ranges from as low as five or six to 200 or more. Health in these circumstances becomes a problem. You can imagine how plentiful toothbrushes are among these people when they have to send to the mainland or Sears Roebuck for such commodities. But, fortunately for the dental phase of health, a missionary boat, maintained for service to these islands and inaccessible seacoast points, is sufficiently interested to aid, and at irregular and infrequent intervals, a dentist is taken to these places, and a little dental work for the children is accomplished.

Maine claims the honor of being the first state to require reporting of Vincent's infection by physicians and dentists, exactly as is required for other contagious diseases. This came about as a postwar measure, and its importance has been emphasized within the past few years when, in so many cases, we have found the Vincent's organisms making impossible the detection of diphtheria carriers. Our division of dental hygiene has assumed as one of its activities assistance in the eradication, control and study of this disease. The Maine dentists have become intensely interested in this, and are giving us splendid cooperation. Our division of communicable diseases requires that each case of Vincent's infection, in an acute active stage, be reported; that the patient be instructed as to the communicability, modes of transmission and destructiveness of the disease, and that all cases presenting a marked ulceration or false membrane shall be quarantined, with the same precautions as surround cases of diphtheria.

This report has given you an idea of the mouth hygiene program and activities in Maine. We realize that our program is by no means perfect; but we are seeing results from our four years' toil. We have not to any great extent embraced the preschool, infant, and prenatal dental activities, as any well-rounded mouth hygiene program should. Circumstances have prevented that, but we anticipate correcting this omission later.

If our department can at any time be of service to persons outside of our state who are interested in our work, we stand ready to assist to the best of our ability.

State House.

DISCUSSION

*E. H. Smith, Libertyville, Ill.:* I was very much interested in Miss Bryant's reference to the importance of education. We have been conducting a health program in Lake county, Illinois, for a number of years, and our experience has been that the educational program is most important. In a survey, we found that sixty-nine of the 102 counties of our state have some degree of dental service, and thirty-six counties have rural dental examinations, including all schools in those counties under county supervision, both rural and small towns, but not including city systems. Sixteen cities or towns in the state have school dentists. Until last year, it was illegal for the school board to appropriate funds for that work, but we now have a law which permits the school board to employ nurses and school dentist. To a large extent, the health program, the educational program, in our state has to be carried on through the school nurse. We have no law permitting employment of oral hygienists in our state. And we have found that unless we can have the cooperation of the teachers, we make little progress in the rural schools. Just before the close of the school year, I examined a school in which

I have been examining the children for five years. Two years ago, about 60 per cent of the children had clean mouths. The school has two rooms. There was a new teacher in the higher grades, and she was not very much interested in health work. The lower grade teacher still was interested. The year following, a new teacher came to the lower grades. And when I returned the following year, we had two teachers to deal with who were rather indifferent to health work. We found one clean mouth in the school of forty-five children. You can see readily how important it is to have the cooperation of the teachers in mouth hygiene work. I have made an examination in a school of about forty children who have been having dental service. Twenty of the children were supposed to have perfect mouths, the work being completed. We found two that had clean mouths, with no cavities. The examinations are not made so thoroughly as they should be, and the fissures are not taken care of. We as dentists should be more thorough in making those examinations if we expect to get results. The importance of this work cannot be overestimated. We have taken a survey of two schools. In the one, a full-time dentist has been employed for about six years. Both schools had a full time nurse. The second school had no dental service. Social conditions were practically the same. The children's parents were American born, probably 90 per cent of them. In the school with dental service, they had a retardation of 5 per cent. In the school without dental service, they had a retardation of 15 per cent. The second school spent $3,575 to reeducate their failures. The first school spent $1,235 to reeducate the failures. The dental service in the school cost them $4.15 per pupil; a total cost of $1,522.10 for the 374 pupils enrolled, with a net saving of $787, a financial return of 50.5 per cent by reducing retardation, plus improved health and mental development. We feel that the work is valuable; and the educational part of it will bring greater results even than the school dentist, because it is impossible to employ school dentists in the rural districts. It is largely an educational matter. The point was made by Miss Bryant that they do not prescribe treatment. We simply make the examination and leave the matter of treatment to the family dentist. We have adopted the plan at the present time of presenting all of the children having 100 per cent clean mouths with a button from the county dental society. This is an inducement for the children to have their dental defects corrected. But it is impossible to succeed in this work unless we can have the cooperation of the teachers and the parents.

*N. Talley Ballou, Richmond, Va.:* In my state, we do not have the dental hygienist. We have a law which has been in force for about ten years which provides that all teachers shall receive a course in one of the state teacher training schools to qualify them to make a simple physical inspection, which includes the teeth. It is my duty to lecture on mouth hygiene in those institutions, and we try to point out to them, among other things, what defects they should look for and how to look for them. We realize the fact that, in this superficial inspection a teacher who probably receives only one lecture on the teeth (there are thirty-six or forty lectures given) may and probably will overlook a great many defects. But we find, from our reports of physical inspections, that the teachers now are finding defects in the mouths of 70 per cent of the children of the state. We have these inspections every year. We have complaints of two characters coming to my office. First, the nurse or the teacher will complain that Dr. A or Dr. B will not fill the temporary teeth. On the other hand, the nurses complain that they do not really know when a tooth has been treated with silver nitrate. We take the treatment of a deciduous tooth with silver nitrate in lieu of a filling. Then, we have complaints from the dentists that the nurses or the teachers are reporting cavities when there are really none, owing to the fact that they see these black teeth and do not know that they have been treated. This is a question that is bothering us considerably in our section, but we are gradually coming to an understanding on it. We passed the same resolution which was passed by the Massachusetts Mouth Hygiene Council, and I have recently had it mimeographed and sent with a letter to all dentists in our state, asking them to cooperate with us in putting the mouths of the children in proper condition and telling them that we will not recognize a certificate from them unless they fill the temporary teeth.

*Harriet Fitzgerald, Berkeley, Calif.:* I wish to tell the members of this group what the Berkeley Dental Society has done in

regard to this problem. It is this age-old story of one dentist saying a tooth should be filled and the other not doing it. We have many dentists who are not up to date in the sense that they want to practice children's dentistry or fill the deciduous teeth. The Berkeley Dental Society has gone on record as wishing to have the children's deciduous teeth taken care of. When I am talking with the mothers, and they say, "I have just been to Dr. A and he told me that these teeth are all right," and I have just had the child's mouth inspected, and it is quite obvious that there are several cavities in the deciduous molars in children 6 or 7 years old, the dentists, realizing that these ought to be filled, have given me the authority to say to this mother: "Dr. A is your family dentist. He is very good, but he is not interested in children's dentistry. Here is a list of dentists in Berkeley (or Oakland, one of the neighboring cities) that will do dental work for children." This list has been made up by the dental society. Now Dr. A may complain: he is only one. The Berkeley Dental Society will say, "We are standing behind the school dental program and we want these children's teeth taken care of." That is the way we are taking care of this problem in Berkeley. I think the result which has been achieved in Berkeley has been due to this cooperation of the Berkeley Dental Society.

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# THE DENTAL HYGIENIST'S OPPORTUNITY FOR PUBLIC HEALTH SERVICE*

By HARRIET FITZGERALD, Berkeley, Calif.

WHEN one thinks of public health, he usually associates with it nurses and health officers, ministering to the public wants, quarantining patients afflicted with communicable diseases to safeguard the community's health; but the real goal of the public health movements is to prolong life by preventing unnecessary sickness and death and at the same time making possible greater health and happiness.

The dental hygienist, by virtue of her profession, is trained to disseminate knowledge which the dental profession has acquired in the field of preventive dentistry. The dental hygienist, as well as the dentist, must take part in the public health program if the goal of prevention is to be attained.

The greatest task of the dental hygienist is to impart this knowledge of prevention of dental disease to the public. When I think of the public, I am thinking of the children of today, the citizens of tomorrow, the mothers and fathers of the next generation. It is with this group that the dental hygienists in California are most concerned. We realize that the public schools which are established by society to safeguard its future afford us the greatest opportunity for service. Therefore, most of our efforts have been directed toward public school children. There are, of course, a few dental hygienists in California who are engaged in office practice and, like other dental hygienists throughout the country, they are rendering a valuable service to the people and are meeting an immediate demand for our educated people.

It is one thing to say that we must educate the children in the public

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 22, 1928.

schools in dental health and another thing to go about it. Some, not Californians, have said that the organization of a dental health program should be carried out through existing agencies, rather than by the creation of new ones —referring, of course, to the profession of dental hygienists; also that no one is in a better position today to advance the cause of dental health than are teachers and the public health nurses. Naturally, the teachers and nurses would be in a position to do this, if they possessed authentic dental knowledge, which the dental profession has given us in our training. They would be the ideal persons to carry out the health program had they had this information and practice.

It has been my experience in working with the public health nurses and teachers that, while they are deeply interested and realize the importance of a dental program in the schools, they feel themselves incapable of carrying it out. Twice each year, it has been my privilege, through an invitation from the director of public health nursing in the University of California, to lecture before the students in public health, who in reality are graduate nurses. After my lecture, discussion is customary, and I am always amazed that nurses have so little information about the teeth. The teacher's dental education usually consists in what she has acquired from her dentist, and that is usually merely a personal matter. If the teacher and nurses are not possessed of adequate dental education, who then is the logical person to impart this subject to the children? Some will say the dentist; but those of us who look into the curriculum for dental students will see that the subjects covered are not sufficient to train the dentist to be an educator in the public school. If he is to be an educator, he must take advanced work in public health, and, after all, his highly technical training is not necessary simply to put over an educational program; for an economic problem then enters into the scheme. Because of his training he must receive a high salary for compensation, and the majority of our school boards cannot afford this.

The dental hygienist who has had two years' training in dentistry, pedagogy and public health can very adequately take this place in the health program and her compensation is such that it appeals to school directors. As Dr. C. N. Johnson has said, the dental hygienist is first and foremost a teacher, whether she is on the staff of a public school, hospital or institution or in a private office. If knowledge alone were sufficient for a health program, the dentist could admirably take his place in the school program, but we know that knowledge alone is not at all sufficient, but it is the application of this knowledge in an interesting manner that makes health programs successful. It is the dental hygienist who can carry out the dental program in an interesting manner.

To quote Dr. William DeKleine[1]:

**Public health dentistry should be developed primarily for the purpose of improving and protecting child health. It should be a health measure first of all. Any special activity in this program which does not accomplish this purpose is not of first importance from the viewpoint of public health. A child with a mouth full of badly decayed teeth and infected roots should be relieved of this infection before anything else is attempted. It seems like wasted effort to give prophylactic treatments to such children without first removing mouth infection and applying those corrective measures which will prevent further decay.**

1. DeKleine, William: Dent. Cosmos. 69: (Jan.) 1927.

It is right here that the greatest value of prophylactic treatments lies. Some never realize why it is that children's mouths are so neglected. Why is it that the teeth are left without dental attention until there is practically nothing to do but extract them? Many will say that it is because of lack of sufficient funds, while others will agree it is due to ignorance of the importance of the teeth. It is due partly to these conditions, but the greatest factor is the fear of the dentist and the fear of being hurt. Pain is always associated with dentistry, and it almost seems that this fear is born within each individual, or, if not, it is soon acquired. Therefore, visits to the dentist are postponed from year to year. Pain is never associated with the service of the dental hygienist. She goes about her work in a most cheerful manner, becoming a friend of the child. She meets the child in the school in a friendly way. Facts about the teeth are told in the class room in the form of stories, or illustrated, and a toothbrush drill is given in the form of games. When the prophylactic treatment is given, the child is first introduced to the dental chair. It is a pleasant experience for him. His teeth and he are the topic of conversation. He realizes that it's not so bad and it really didn't hurt. He resolves to go to the dentist and have his dental defects corrected. His fear has been overcome and his pride aroused through this contact with the dental hygienist. Thus, we see that it is not the mere fact that the child has had his teeth cleaned that aids in our preventive dental program, but the fact that the child has been educated to the importance of good teeth.

Dr. Edith S. Bryan, associated professor of public health nursing at the University of California, in speaking of the mental attitudes of the child, said: "It is the approach that is made to the child that determines its attitude forever after on the subject." How well this applies in the case of dentistry for school children. The dental hygienist approach is so different from that of the dentist.

There is perhaps no better place to put over the educational dental program than at the chair, but this is not always possible. Many times but one dental hygienist is employed in a school district, and her territory is so large that she cannot reach all the children individually, and the prophylactic treatment is given to one as a demonstration before the group, with instructions. My experience has revealed to me the value of group instruction in dental health education.

For many years in Berkeley, the public school department enjoyed the privilege of having a school dentist who labored long and hard at an endless task of reparative dentistry. Twelve years of continuous service was rendered, and while a great deal of good was accomplished, the task of caring for more than 6,000 school children was well nigh impossible. Only a very small number were cared for, and follow-up work from a preventive standpoint was impossible. Yet, when a dental hygiene program was introduced three years ago and the dentist was taken out, because of a legal interpretation of the school law, comments and criticisms from all sides faced the school department and the department of health education. To some, it seemed a foolish thing to take the one dentist out and put in a dental hygienist, because it was ruled that the hygienist could only inspect and do the educational work. Fortunately, the director of health education, a man deeply interested in public health, favored the

introduction of the preventive dental program through dental health education.

Mine was not an easy task in a city where culture and knowledge is abundant, where the school department is composed of only the best the university has to offer and where everyone accepted the services of the school dentist as an essential part of the health program. Many times, had it not been for the encouragement of Dr. W. P. Shepard, director of health education, and Dr. Guy S. Millberry, dean of the University of California College of Dentistry, my enthusiasm for the work might have waned. Blazing the trail was not an easy task, despite the fact that I enjoyed being a pioneer.

My first step was to make a survey of a cross-section of our city, lecturing in each classroom and afterwards examining each child with a mouth mirror and explorer. The parents were notified of the defects in each case. This survey was carried on in the first, second and third grades, and 1,703 children were examined. Of these, 1,308, or 81 per cent, had defective teeth, while only 323, or 18.9 per cent, had good teeth. Is it any wonder that the community was startled at this finding after having a dental program for twelve years?

My next step was to make an educational outline, which I carried out, giving different work in the kindergarten and first, second and third grades. I visited each classroom every two weeks, and different phases of mouth hygiene were presented. Some talks were illustrated; others were in the form of stories, and toothbrush drills were given in the form of games. Teachers, children and parents became interested. The nurses saw the changed attitude in the children. Visits to the family dentist became popular, and the Health Center Dental Clinic had more patients. Children were promised "Good Teeth Buttons," if, on examination, they had 100 per cent good teeth. These buttons were donated by the Berkeley Dental Society. In the fall of the same year, the children were again inspected. Only 58.4 per cent had defects, instead of 81 per cent. The same program was carried on; and just one year after the first survey, only 40 per cent had defects and 60 per cent had good teeth. This same program is still in effect. The kindergarten and first, second and third grades are examined twice each year and the educational program is carried out, but the classes are visited but once a month owing to the increase in the number of schools that have to be visited. A prompt follow-up program is the practice; for, in my opinion, this is the only way good results can be achieved. The same children are checked up from year to year. At the present time, and from now on, all children in the elementary schools will have had dental instruction. During the last year, I did some special work with the fourth, fifth and sixth grade children, who were in first, second and third grade when the program was first introduced. In one school, where 58.9 per cent of the children had defects in 1925, in 1928 there were but 22 per cent having defects and 78 per cent good teeth. When these children were questioned on some of the dental instruction which was given them three years ago, they showed that they had not only retained the information but were actually applying it.

I recall examining a boy in sixth grade last year who, as when in the third grade, was quite a problem. At that time, his mouth was in bad condition. All the first permanent molars

were decayed, and although notices were sent his mother and home visits were made by the nurse, all efforts seemed in vain. This year, on examination, this boy's mouth was in a very good condition despite the fact that two of his molars were missing. The other teeth were clean and filled. I asked him why it was that he didn't go to the dentist sooner. He said that he never knew about his teeth, whereupon I showed him his card, on which all the home visits were noted. "Oh, yes," he said, "but when you showed us the slides on 'Johnny Don't Care's Tooth,' I really knew. I could see it. So I had my mother take me to the clinic." I recalled that these slides were not shown to the third grade, for they were not in my possession at that time. It was not until two years later that they were shown to the fifth grade, and it was after that that this child had his teeth attended to. This is but one case, but there are many others similar to it. In my opinion, there is nothing better than visual education for putting over some parts of our dental health education, and especially is this true in trying to show children why they should visit the dentist regularly.

As Dr. W. P. Shepard, formerly director of health education in Berkeley and now assistant secretary of the Metropolitan Life Insurance Company, has said:

> The Berkeley Health Education plan was unique, at the time the work of the dental hygienist was begun, in the following respects:
>
> (1) A shortage of school nurses, leaving comparatively little time for the nurse to do formal educational work.
>
> (2) Lack of a health education specialist to coordinate the health teaching of the nurses and teachers.
>
> (3) A ruling from the district attorney to the effect that it was illegal for the board of education to expend funds for the actual cleaning of teeth in the schools.
>
> In the face of this situation, a dental hygienist was appointed by the board of education to examine the children's teeth and to teach them proper care of the mouth. The dental hygienist was especially qualified both by training and temperament to do this work. The teaching methods in the classroom won the admiration and respect of teachers and became very popular with the children. In addition to this, the tactful notification of parents of the presence of dental defects brought about an unexpectedly high percentage of corrections. In spite of the handicaps in the situation, therefore, the work became very valuable to the Berkeley School system and was the object of popularity by parents and teachers alike.

Our program in Berkeley is not complete, but it has been an attempt to remedy existing conditions. Soon, we hope to have more dental hygienists and have the prophylactic treatments in the schools. We hope thus to carry our educational program further. The success of this public health dental program in Berkeley has been due, first, to the whole-hearted support of the director of health education, and then to the local dental society, the public health nurses, and last but not least, the classroom teachers and the principals, for they have welcomed the dental health educational program. Dr. Kelly, professor of public health at the University of California, has voiced the opinion that the dental hygienist is an essential factor in the school program.

It was the motto of the California Dental Hygienists' Association, "that we may educate ourselves and serve the people, primarily the school child," that inspired me to do public health work. Oliver Wendell Holmes said: "It is faith in something and enthusiasm for something that makes a life worth look-

ing at." May we all have faith in our preventive dental health program and may we keep up our enthusiasm in the years to come.

Health Department, City Hall.

DISCUSSION

*N. G. Slaughter, Athens, Ga.:* Miss Fitzgerald's work is in line with what we have been doing in Georgia. In Athens, we have had 100 per cent corrections in the elementary schools for three years. The success of the program has been due to a spirit of cooperation, the Athens Child Health Demonstration, the board of education, the board of health, the parent-teacher associations, the dentists—in fact, almost every citizen was interested. About four years ago, the Eighth District Dental Society became interested in a health program, and the Athens Child Health Demonstration kindly consented to employ a dental hygienist. The hygienist is an essential factor in a dental health program, and, in many respects, is better fitted for the work than a dentist. A program of this kind is always a joy to those working for the welfare of boys and girls. The time is not far when we can have a dental health program that will reach every community of this nation. This could be done under the auspices of the American Dental Association and some of the great philanthropic foundations. We could carry out a program that would reach not only boys and girls of the city but also those of the rural communities, in which about 95 per cent of the children need dental corrections. Wouldn't it be a great objective to give each one of them a chance to be strong and healthy? Even from a medical point of view, would it not be about the best preventive program that could be adopted? In an adjoining rural county, without a dentist, the ladies' auxiliary of the medical society has as its objective a dental program for all the school children and have asked the cooperation of the Athens dentists. This is a beginning, and may the time soon come when preventive dentistry will be known in the remotest sections. The dental hygienist will play an important part in such a program.

*E. Melville Quinby, Boston, Mass.:* There are one or two points that impressed me, coming from the East; and one is the way Miss Fitzgerald speaks of a two-year course for dental hygienists. That question is perhaps more definitely settled in the West than it is in the East. I believe in education and I believe in practical work. This idea of segregating the duty of the dental hygienist does not appeal to me because there is always an educational point as well as a practical point. But there ought to be a certain amount of general understanding as to the status of the dental hygienist in the community as a link in general health service; not just dental health service, but general health service. There is a serious lapse in the curriculum of the medical profession in that they do not focus to any extent on the oral cavity. I was educated as a medical man, so I know whereof I speak. The statement that Miss Fitzgerald made about the medical nurses is to be expected. If the medical profession fail to focus their attention on the subject of oral conditions, we can hardly expect the medical nurses to do so. In other words, there must be an all round change in the point of view regarding health service. It must be much more inclusive. Focusing on any one factor of disease is a mistake; and what we need is to change our point of view and begin all over again if we are ever going to be of any value in health service.

# PRESENTING THE DENTAL OFFICE TO THE CHILD*

By GLADYS I. SHAEFFER, D.H., Lancaster, Pa.

THE position of dental hygienist was created a few years ago, for the purpose of disseminating to the lay public truths about their health and well-being, thus adding to their happiness. It is the avenue through which the dental profession can and is educating the present generation and, in so doing, is making better citizens. With the profession lies the responsibility of sending through that channel what they, through their years of training and later experience, deem the essentials of proper living and good health.

Realizing that the creators of the profession of dental hygiene are interested to an appreciable degree and that the dental hygienists themselves are enthused to the point of obtaining results, let us consider our working material, the child.

Most of us are so unfamiliar with children that we are uncomfortable in their presence. Primarily, it behooves us to remember that they are human beings, plastic clay, on which impressions made are often lasting. Coming in contact with children is a privilege presented to us. "As a twig is bent, so the tree inclines." What an excellent opportunity to give some boy or girl the proper start in life. "Like an intelligent animal or machine, the child responds to the impressions he receives in a manner determined by his structure and constitution. He is not, to be sure, a purely automatic machine, but his intelligence appears not in doing from the first what is wise and well calculated, but in his capacity to learn enough of himself and his world to enable him eventually to act wisely or effectively in new situations, to solve problems, to adopt new purposes."[1]

Let us analyze the situation more carefully. The boy, who is at a very impressionable age, is taken to the dental office by his mother. He translates the new environment in terms of familiar objects. Probably his mother has, on some previous occasion, refused to take him to the dentist's office with her. The popular excuse given to the child is a story about how people have teeth pulled out and are hurt generally, in such offices. Naturally, these are the things that creep into the boy's mind as he steps across the threshold for his first visit.

With such a prologue, the task presented to the dentist or dental hygienist, is one of overcoming fear. Accepted that we recognize our subject, the child, as a human being, very impressionable and, fortunately for us, of an adaptable disposition, let us blot out the prologue staged by the average parent and present to the child the newer dental office—present it in such a way that the man of later years will be a living example of the ideals of the profession.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 21, 1928.

1. Gruenberg: Outline of Child Study.

The office, whether it be a school clinic or private one, must be attractive. To be attractive to the child, it must be colorful and immaculate. Color attracts attention. After attention has been attracted, the curiosity will have been aroused. "Curiosity is the mother of all knowledge," says Plato. The twin sister of curiosity is interest. Interest that is educationally valuable is not that which pleases and amuses, but that kind of interest which causes effort to be put forth in order to satisfy the hunger for knowledge. Curiosity, like play, may be stimulated to an immense amount of what would otherwise be drudgery.

Interest, in this particular instance, can be aroused by having familiar things in conspicuous places. The dental engine, most dreaded instrument of torture, should occupy an obscure position in the dentist's office and should be conspicuous by its absence in the office of a dental hygienist. In some cases, the child, if he is of a mechanical turn of mind, can be interested in the construction of the instrument. In all cases, the engine should be carefully explained so that fear on the part of the child may be eliminated. Fear kills interest. When a child stops in his path and says, "I can't," one of two things is true. He is frightened by the unfamiliar situation or he really has not the power to do what is wanted. The new thing startles all of us. There is always the element of fear in every new undertaking. Until the storm of dread and fear subsides, the mind cannot assert control. Go backward for a space and come through on another road, feeding the material more slowly until the child finds himself in familiar territory.

If interest is aroused on the first trip to the dental office, the battle is half won; for, with interest manifested, faith has been established and fear has gone. On the second trip, the child is no longer in strange environment. He relaxes; being interested, he asks questions and, having been informed about the procedure, he will possibly permit the operator to do some actual work for him. It has been said that children care more for people than for things. They learn more from animate than from inanimate objects. In that event, the dentist or dental hygienist is the most important part of the office. He or she should have the ability to invite confidence. If his knowledge of human nature includes an understanding of children, an ability to translate their reactions in their terms, their faith in the operator is assured.

The fact that the child is primarily and basically an imitator is valuable information for the dentist at this point. The habit of imitation is traceable from shortly after birth through the whole life. During some periods, the trait is more outstanding than in others. Gruenberg[1] has divided this trait into the following periods:

1. Reflex imitation, noticed during very early age. The child repeats your actions, though on his part having no part in the procedure.
2. Spontaneous imitation: much the same as reflex, but of a more accurate nature.
3. Dramatic imitation: repetition for the sake of attracting attention.
4. Voluntary imitation: repetition because of personal benefit derived.
5. Idealistic imitation, occurring during a period of hero worship.

This tendency in children presents a golden opportunity for teaching by example. Care of the mouth can be properly established at an early age in this

way. A child will notice the specific movements made by others and then reproduce them with approximate correctness, increasing his accuracy with practice.

While the care of the mouth is becoming a habit, the general hygiene of the body should gradually be included in the conversation. And by included is meant, not having health the topic of conversation but rather making practical application of a health principle in general conversation. A child should be unconscious of his body. Health is a matter of habit, and habits of children are formed largely through suggestion. Our responsibility lies, then, in repeated health rules. Taking care of your body is a privilege. Give the child a share in the work. Do not let us be the dentist and dictator while the child occupies the position of patient and recipient. Add an appeal for help. When it is our work, it is so different from when it is your work. "Go brush your teeth," speaks of a chilly, lonesome road. The child lags and holds back in hope of a lift and a word of cheer. Children need that more than we do; yet most of us keep the "come" for our grown up friends and lavish the "go" on the children. No policeman can capture or command a mind; no material force can dominate a spirit.

It is our duty therefore to present to the child our best knowledge of health, in the most intelligent manner and from within an office to which it is a pleasure for that child to come.

I appeal for more consideration and better understanding of the child of today, the parent of tomorrow.

## CURRENT LITERATURE

### EXTRACTS AND ABSTRACTS

*Vincent's Infection of the Nose:* A case of Vincent's infection of the nose in an Italian Boy, aged 3 years, is reported by Harold I. Shulman *(Am. J. Dis. Child.,* August, 1928). The patient was prostrated and somewhat toxic. The chief complaint was a persistent bloody discharge, mixed with mucopurulent material and of fetid odor, from the left nostril. The left side of the upper lip was swollen and excoriated and a greenish yellow membrane almost completely covered the mucous surface of the upper lip. The gums were congested and bled when touched. A few small irregular whitish areas were seen on the margin of the upper gums between the teeth. Tonsils, pharynx and palate were seemingly uninvolved. The left submaxillary and submental glands were much enlarged and tender, and the left anterior cervical glands were also enlarged, though not tender. Smears and cultures from the nose, lip and gum showed an enormous number of fusiform bacilli and spirilla. The nose, lip and gums were swabbed with half strength hydrogen peroxid and a 5 per cent chromic acid was applied. The excoriated skin was annointed with 5 per cent ammoniated mercury. A dentist examined the patient and found the teeth in good condition. After a few days' treatment, the condition improved, and nasal irrigations of sodium perborate were substituted for the chromic acid treatments. Potassium permanganate, 1:5,000, was introduced as a mouth wash, to be used every hour. On the eleventh day smears were negative. Schick and tuberculin tests, as well as roentgen-ray examination of the teeth, were negative. The patient was discharged as cured on the nineteenth day.

*Terms Used in Radiology:* Terms recommended for use in radiology by the Sub-

committee on Nomenclature of the American Medical Association (Pancoast, Failla and Watkins, *J. A. M. A.*, Sept. 29, 1928) include: Radiology, the broad subject of the medical use of roentgen rays in diagnosis and treatment and of radium in treatment. Radiologist, the person employing the roentgen rays and radium as a specialist. Roentgenology, a branch of radiology dealing with the roentgen rays. Roentgenologist, a person employing the roentgen rays in diagnosis as a specialist. Radiotherapy, or irradiation therapy, the therapeutic application of radium and the roentgen rays. To designate the use of either agent alone, roentgen or radium therapy is the descriptive term. The committee states: "We strongly recommend the use of the prefix 'roentgen' in all connections with all direct references to the sole use of x-rays . . . The term 'roentgenogram' is compulsory because that of 'radiogram' is now employed to designate a message transmitted through space and should not be used in a medical sense. 'Roentgenograph' should not be used as a noun as is 'photograph,' but it will probably have to be adopted as a verb to designate the examination of a patient by the making of roentgenograms. It is an undesirable word but the adoption of 'radiograph' is unwise, first, because it conflicts with a standard nomenclature, and, secondly, because it is likely to be adopted in the future in connection with the radiotransmission of pictures. Other derivatives of the prefix 'roentgen' would be 'roentgen therapy,' 'roentgenology' and 'roentgenologist' and 'roentgen diagnosis.' . . . 'Radiation' applies to the radiant energy emitted by the x-ray tube, radium, etc. 'Irradiation' refers to the application of these agents. The use of the word x-ray is to be limited to its application to physical problems and to apparatus. The term is not be to used as a verb (i. e., 'x-ray the patient')."

*Treatment of Cancer of the Tongue:* From 1920 to 1925, Moure *(Bull. M., Paris)* operated on forty-two patients for cancer of the tongue. A recent follow-up of twenty-two cases revealed the fact that the cancer had not recurred in ten of the cases in which operation had been performed from two and one-half to six years ago. For small, beginning cancers of the tongue and for suspected lesions, particularly plaques of leukoplakia undergoing degeneration, the author recommends extensive resection with the bistoury under local anesthesia. In these cases of leukoplakia, he fears the stimulating and irritating action of radium on the adjoining plaques which are not in the field of destruction. In clinically evident but still limited cancer of the tongue, he likewise uses the bistoury and local anesthesia. The use of radium, which is less mutilating, is objectionable, owing to the necrosis and the lymph gland reaction which it produces. Another objectionable feature of the use of radium is the fact that a patient in whom a cancer recurs after an application of radium is usually lost, because a second application results in disastrous necrosis and because surgical wounds made in irradiated tissues heal badly. On the contrary, if a cancer of the tongue treated surgically recurs, one can then use radium to good advantage. In cases, however, in which the lingual lesion is so inaccessible that surgical treatment would necessitate section or resection of the inferior maxilla, Mours uses radium, because it is much less dangerous than the operation.—Abstr. *J. A. M. A.*, July 28, 1928.

*Dental Statistics:* The Director of the Dental Division of the Metropolitan Life Insurance Company, in collaboration with the Statistical Bureau, has recently published figures gathered from the results of periodic examinations of Home Office employees. In twelve years, among nearly twenty thousand employees, only two sets of perfect teeth have been found. Among the others, making due corrections for missing teeth, a schedule of susceptibility of various teeth to decay was worked out. The group studied consisted of 2,943 persons of both sexes under the age of twenty-five years. The occlusal surfaces of the first and second molars, by a large margin, lead all the others in incidence of decay, actually averaging more than one occlusal cavity per tooth. The occlusal surfaces of the two upper bicuspids came next in order, although their susceptibility was less than half that of the first and second molars. Curiously enough, the first bicuspid of the lower jaw is relatively resistant to decay on the occlusal surface. Of surfaces other than occlusal that reach the level of 50 per cent susceptibility are the buccal surfaces of the lower first molars. The incisors are relatively resistant, their few cavities falling almost exclusively on the mesial and distal surfaces. At this age, the third molars, of course, had not been exposed to decay. Fur-

ther information is now desirable on the exact causes of dental decay. Diet, we know, plays an important part, but even among the dentists the factors which increase or decrease individual susceptibility are not clearly shown, with particular reference to those factors affecting the primary composition of the teeth.—*New England J. Med.*, Aug. 2, 1928.

## Foreign Literature

*Special Pathology of the Mouth (Hans Moral, Fortschr. d. Zahnheilk.,*[1] *No. 2, 1928, p. 136):* The size of the wound has little to do with the prognosis of bleeding. Seidel has found thirty-two deaths reported in the literature from bleeding following extraction. It is a common practice to call all abnormal bleeding hemophilia. There are numerous cases of abnormally profuse or abnormally prolonged bleeding that are brought about by numerous other causes. That the arrest of profuse bleeding is dependent on the coagulation of blood is still quite generally accepted; yet today we know that coagulation is only one of the factors involved in the arrest of hemorrhage. Coagulation time is independent of bleeding time. Bleeding time is influenced by surrounding temperature—if the temperature is low, more blood is lost than if it is high. In hemophilia, the coagulation time is increased, while the bleeding time is normal. In thrombopenia, the coagulation time is normal, while the bleeding time is increased. Hemophilia contraindicates extraction or other surgery. There is no fixed time for the bleeding time. Constrictions placed about the upper arm produce little change in normal individuals; while, in persons affected with thrombopenia, peripheral hemorrhages are produced within fifteen or twenty minutes. From bleeding alone, it is impossible to differentiate between hemophilia and atonic bleeding. For diagnostic purposes, the causes of bleeding are classified as local and systemic. These are discussed at some length. This is followed by a chapter on metastatic infections and another on cysts and the causes which lead to their probable development.

Emil Mueller, Chicago.

*Histopathology of the Teeth (Karl Zilkens, Fortschr. d. Zahnheilk., No. 4, 1928, p. 291):* Two important texts on this subject have appeared in Germany during the year, one by Sigmund and Weber and another by Euler and Meyer. In this article, the author proposes to discuss the progress recorded in the literature on various subjects. Concerning the nutrition of the enamel, limited progress has been recorded during the year. Harris and McKay have shown that the discoloration in mottled enamel is found on the inner prismatic substance of the enamel. The author considers unorganized, detached denticles the product of regressive changes of the pulp and therefore not deposited by odontoblasts. "Turner" teeth have been quite extensively studied by Meyer. He reports many cases of mal-developed permanent teeth that have resulted from abscessed temporary teeth. Smaller or larger portions of the tooth germs may be affected, this depending on the duration and extent of the abscess. As a result, there may be developed only fragments of enamel and dentin. These may later have cementum deposited on them. Caries of cementum has been studied by Euler. He has observed that the manner of progress of this caries differs with the types of cementum; viz., fibrous primary and lacunar secondary. Interesting cases of fractures of cementum and the succeeding repair are also recorded by Euler and Meyer. Kronfeld has shown that hard substances are acted on differently by resorption, this depending on the degree of calcification. Many interesting experiments with exposed pulps are recorded and the conclusions reached upon the basis of these are that exposed pulps, even when treated under most favorable conditions, are usually lost.

Emil Mueller, *Chicago.*

*Histology and Development. (Balint Orban, Fortschr. d. Zahnheildk., No. 9, 1928,*

1. "Fortschritte der Zahnheilkunde," freely translated, means "progress in dentistry." This publication is not a magazine in the accepted sense of the word, but a book published monthly. The twelve copies constitute one volume. The book is edited by Dr. Julius Misch of Berlin, and published by George Thieme of Leipsic. The same subjects are treated by the same authors once each year. The authors offer a comprehensive review of all the important developments in their field. It is the aim of the editor to have the authors furnish as complete bibliographies as can be offered on their subject. Fully half of each number is devoted to abstracts of dental literature from the whole world.

*p. 797):* In this article, we are offered a review which covers the metabolism of the enamel, the biology of the pulp, the dentino-enamel junction, the dentino-cemental junction and Hertwig's epithelial sheath. In the discussion of the metabolism of the enamel, the author deals with all the literature on this subject and offers us in brief form the latest information in this field. Orban has been the first to observe that epithelial rests are frequently found in the proximity of organized denticles and fully developed teeth. He believes that epithelium is always necessary for the development of organized denticles.

EMIL MUELLER, *Chicago.*

*Dental Complications from the Maxillary Sinus and Their Treatment (G. Stein, Ztschr. f. Stomatol.,[2] No. 8, 1928, p. 763):* In describing the complications which may occur in the maxillary sinus, the author calls attention to the danger that may arise during a radical operation on the sinuses if the relation to the apices of the teeth is neglected. If the maxillary sinus is accidentally opened in the process of extraction, root amputation, root-canal treatment, etc., it is best to do nothing but observe. There is given a case in which a guttapercha point had been forced into the sinus. The substance disappeared within ten months and no disturbance followed. Communications between the maxillary sinus and the mouth cavity should be treated with a plastic operation.

BALINT ORBAN, Chicago.

*A Modification of the Cyst Operation of Partsch (O. Hofer, Ztschr. f. Stomatol., No. 8, 1928, p. 806):* The technic of cyst operation originated by Partsch is as follows: A wide opening of the cyst is made toward the mouth, with approximation of the mucous membrane of the mouth with the epithelial lining of the cyst. Care should be taken to prevent closure of the opening until the cavity of the cyst becomes closed from within. In cases in which it is difficult to bring the mouth epithelium into contact with the cyst epithelium because granulation tissue prevents it, Hofer advises the following modification: The cyst should be widely opened, and a piece of compound fitted into the cyst cavity. A piece of skin (Tiersch) from the arm or the leg of the patient should be placed on the compound with the epithelium toward it. The compound, together with this transplanted tissue, is refitted into the cyst, the compound holding the tissue to the place where the granulation tissue prevented union. Within a few days, the epithelium of the transplanted skin will unite on one side with the epithelium of the mucous membrane of the mouth, and, on the other side, with the cyst epithelium.

BALINT ORBAN, Chicago.

*Contribution to the Knowledge of the Origin and Nature of Follicular Cysts (J. Lartschneider, Ztschr. f. Stomatol., No. 9, 1928, p. 871):* Fourteen cases comprise the basis for investigation. Eight of the follicular cysts (cysts which originate from tooth germs) were observed in bicuspids; six, in third molars. In the cases of the bicuspids, the pulps of the corresponding deciduous teeth were badly diseased. The author believes that the development of follicular cysts is due to the spreading of the inflammatory process to the germ of the permanent tooth. Therefore, follicular cysts have to be considered as the result of inflammatory degenerative process on the tooth follicle. The cysts connected with the third molars develop, as the author claims, because of the spreading of inflammatory processes from the tonsils.

BALINT ORBAN, Chicago.

*Surgical Anchorage for Plates on the Edentulous Lower Jaw (E. B. Weigele, Vierteljahrschr. f. Zahnheilk.,[3] 44, No. 2, 1928):* The article begins with a review of many interesting contrivances, both surgical and mechanical, that have been used in the past hundred years for the retention of all forms of dentures. Surgically implanted gold screws and ivory roots; mucous membrane loops transplanted and sewed to the lingual border of the mandible; impacted teeth reached by drilling through the process; wiring plates

2. "Zeitschrift für Stomatologie" means "periodical for stomatology." This magazine appears monthly in Vienna, Austria. It is the official organ of the Dental Association of Austria, and is edited by Emil Steinschneider. Research as well as practical problems form the content. The publishers are Urban and Schwarzenberg, Vienna.

3. "Vierteljahrschrift für Zahnheilkunde" means "quarterly magazine for dentistry." This magazine appears every three months. It is edited by P. Adloff, in Königsberg, and published by Herman Meusser, in Berlin.

to the jaws; metal retaining springs between upper and lower full plates; weighted lowers; suction appliances, etc., are here considered. The edentulous lower jaw, being the most difficult case to construct a satisfactory plate for, especially where there is very little or no ridge left, is the author's main concern in this treatise. The ideal form of ridge presents a high prominence anteriorly, and this he has produced in several patients between 70 and 75 years of age, by placing a suitably shaped piece of ivory underneath the periosteum at this point. The method of operation is to make an incision horizontally midway between the lower lip and point of chin to the mandible, raise the periosteum and gum, exposing the mandible entirely from first bicuspid to first bicuspid (being careful not to puncture the mucous membrane into the mouth), lay a sterile ivory implant on top of the ridge, and wire it to and around the body of the mandible, and close the incision. Of course, this must be done in the hospital, but the operation is not so severe as it at first seems, and can be done in twenty minutes. Four cases are cited. The last patient, a man of 75 years, was operated on in September, 1926, and the plate was placed in his mouth twenty-five days after operation. He has now had it one and one-half years, and is well satisfied with it. Although it is expected that some change will take place owing to the absorbability of the ivory implant, at present no shrinkage of the artificially created hump is evident; nor do the roentgen-rays show any shrinkage or absorption of the implant. This may be due to the extreme age of the patient. The author feels that in consideration of the indifferent success that is being attained in other branches of dentistry, for instance, root-canal work and fixed and removable dentures he has cause to be satisfied with his results so far attained.

JAMES D. FRANKEL, Chicago.

# MISCELLANY

## BOOK REVIEWS

*Dental Medicine.* By F. W. Broderick, M.R.C.S., L.R.C.P., L.D.S. (Eng.), Hon. Dental Surgeon to the National Sanatorium for Diseases of the Chest, Bournemouth. 364 pages; price, $6.00. Published by C. V. Mosby Company, St. Louis, Mo.

The author of this book goes rather exhaustively into the subjects of acidosis and alkalosis, endocrinology, calcium metabolism, "the relationship between changes in the acid base equilibrium of the blood and dental caries," and pyorrhea alveolaris. The trend of the book is therefore along modern lines, and this part of the work might appropriately have been called "Dental Pathology." Later, the author takes up the consideration of the prevention and treatment of dental caries and of pyorrhea alveolaris. This is followed by a consideration of dental sepsis as a factor in disease. A close study of this chapter will disclose the fact that the author does not believe that all the ills to which humanity is subject come from the teeth. Throughout his work, he quotes quite extensively from other writers, and thus gives the reader the impression that he is desirous of presenting all sides of the question. He has evidently read very extensively on the various subjects, and his conclusions are therefore well worthy of consideration.

*The Science and Practice of Dental Actinotherapy.* By Thomas Victor Tanguy, Formerly Lecturer and Demonstrator on Dental Anatomy and Dental Anesthesia at the Manchester School of Technology. 111 pages; 13 illustrations; price, $3.00. Published by C. V. Mosby Company, St. Louis, Mo.

While a great deal has been written on ultraviolet ray therapy in the treatment of disease, this is claimed to be the first book that has been issued on the subject. It is practically a new treatment, and as the author intimates, it is subject to the same vicissitudes that accompany any new idea. It has been heralded as a cure-all, and the author has done well to call attention to the necessity for conservatism in its use, and for a recognition of its limitations. A brief historical sketch is given, and the nature and action of the ultraviolet rays are considered, and finally its use in the various

dental ailments. It is a book that will be found especially useful to beginners, and even those who have used the ultraviolet rays will discover much of value in its pages.

*Diseases of the Mouth.* By Sterling V. Mead, D.D.S. Professor of Oral Surgery and Diseases of the Mouth, Georgetown Dental School; Professor of Diseases of the Mouth, Georgetown Medical School; Oral Surgeon to Georgetown Hospital; Dental Surgeon to Gallinger Municipal Hospital; Consulting Dental Surgeon to Washington Sanitarium and Hospital; Consulting Dental and Oral Surgeon to Shady Rest Sanitarium, Washington, D. C. 727 pages; 336 original illustrations in the text and 43 color plates. Third edition, price, $10.00. Published by C. V. Mosby Company, St. Louis, Mo.

The first edition of this book was reviewed in the December, 1927 issue of THE JOURNAL, and in view of the fact that three editions have been called for in less than a year, it must be apparent that the book has made an unusual appeal. In the third edition, new illustrations have been added and the text has been amplified to bring the subject well up to date. We bespeak for this volume the same cordial reception that was given the earlier editions.

*Notes on Dental Anatomy and Physiology and Dental Histology (Human and Comparative). A Note-Book for Students, and a Ready Work of Reference for the Busy Practitioner.* By T. W. Widdowson, Licentiate in Dental Surgery of the Royal College of Surgeons of England, Lecturer on Dental Anatomy and Physiology at King's College, University of London; Late House Dental Surgeon to the Liverpool Dental Hospital; Late Contributing Editor to "Oral Health," and "Dental Practice," Toronto, Canada. Author of "The Care and Regulation of Children's Teeth," "Notes on Dental Surgery and Pathology," Etc. With nearly 500 illustrations and six plates. Fifth edition. 588 pages; price, 25 shillings. Published by John Bale, Sons & Danielsson, Ltd., 83-91, Great Tichfield Street, W.1, London.

The author of this book has drawn quite liberally from other authors for his illustrative material, and thus presents a most representative grouping of the ideas of many writers. Evidently, he has familiarized himself with the theories of all the writers on this subject, and has gathered the material having the most significant bearing on the topics treated. The chapters on development are very full, as are also those on comparative dental anatomy.

The book is based on lectures delivered by the author at King's College, University of London, and the entire work indicates a familiarity with the subject that makes it authoritative. To those who are interested in the sciences under consideration, this book will prove very helpful.

*Care of the Teeth, or Layman's Handbook of Dentistry.* By Minoo C. Bilpodiwala, M.B., B.S., Physician and Dental Surgeon. 134 pages. Published by the author. Empire Building, Hornby Road, Fort, Bombay, India.

This little book is an earnest effort to spread information among the people of India—where it seems to be particularly needed—on the subject of mouth hygiene. It has the endorsement of some of the leading practitioners of that country, and there is a foreword by Dr. J. J. Modi, who is well known in India. Its teaching is, on the whole, sound, and it will undoubtedly do great good.

In some of the nomenclature, it would have been better if different terms had been used. To teach to the people, for whom this book is largely intended, such names as "canine," "six-year molars," "wisdom teeth," etc., is merely to extend erroneous terms on into our coming generations. Our profession is largely accountable for most of the bad nomenclature used by the laity, because it is from the profession that the laity gains its information on the teeth.

Dr. Bilpodiwala's book will do much good in his country and we bespeak for it a cordial reception.

## INTERNATIONAL DENTAL FEDERATION DENTAL RESEARCH PRIZE

The F. D. I., in consideration of the importance of the problem of root canal treatment and the necessity of obtaining a technic which will render pulpless teeth free from danger to the health of the individual, desires to promote laboratory and clinical research in this field by offering a prize. This prize, which will consist of a gold medal together with the sum of $1,000, will be awarded at the next international congress in Paris, in 1931. Candidates must

notify the Secretary of the Scientific Commission of the F. D. I., Dr. J. Weinmann, Wien, IX. Frankgasse 1, before July 1, 1929, of their intention to enter for the prize.

Each candidate must submit a description of his method in one of the Congress languages (English, French, German, Spanish), together with a record of ten treated cases to the same Secretary before July, 1930, through their own National Committee of the F. D. I. or that of a neighboring country. Of these ten cases, at least three must involve extraction of the living pulp (of which at least one must be a bicuspid and one a molar), and at least three must be gangrenous pulps (of which, again, one is to be a bicuspid and one a molar).

The case records must be accompanied by all available evidence of the efficiency of the method, and the responsibility for furnishing this evidence will lie with the candidate. Roentgenologic evidence alone cannot be accepted. The Commission for Scientific Research of the F. D. I. considers the biologic method to be the most efficient at present available. The candidate is, however, at liberty to control his technic by this or any other adequate method. The jury similarly reserves to itself the right to control any technic submitted by this biologic method or by any other which they may consider adequate.

It is desirable that at least two of the ten treated teeth should remain in the mouth as long as possible after treatment is completed in order to furnish clinical evidence in support of the biologic control.

The jury consists of the President of the F. D. I., Professor Aschoff, Freiburg-in-Bresgau, Germany; Professor Laidlow, London; Percy R. Howe, Boston, Mass., and Edward C. Rosenow, Rochester, Minn. The president of the F. D. I. may appoint a substitute in the event of a vacancy occurring in this list.

The following histologic laboratories are prepared to undertake the biologic tests for those unable to do the work themselves, charging only the actual laboratory expenses of the investigations to the candidates:

Zahnärtliches Institut der Universität Breslau, Breslau, Burgfeld 17-19.

Chicago College of Dental Surgery, Dental Department of Loyola University, 1747 W. Harrison St., Chicago, Ill.

The John Hampton Hale Research Laboratory of the Royal Dental Hospital and School of Dental Surgery, Leicester Sq., London, England.

Histologisches Laboratorium des Zahnärztliches Institutes der Wiener Universität, Wien 9, Währingerstr. 25 A.

A Subcommittee of the Commission on Scientific Research of the F. D. I. will be appointed at the meeting in 1929, to scrutinize the papers submitted in order to see that the rules have been observed by the candidates.

The biologic control method for root canal treatment is as follows:

Using teeth which are destined for extraction: After the root canal work, the teeth are extracted in a sterile manner. After an anesthetic is given, the pocket around the tooth is scarified by the actual cautery and the tooth and the surrounding tissue is painted with iodin. The tooth is then extracted, with sterile forceps; and with a sterile splitting forceps, the apical third of the root is cut off. During this last operation, sterile cotton wool is kept around the beaks of the forceps and the tooth to prevent dropping the apex. The apex is then implanted in the leg muscles of a rat under strictly aseptic conditions. (The best place is close to the femur.) The wound is then closed by double suture (muscle and skin suture).

The weight of the rat is charted and the animal is well fed and kept under good hygienic conditions. During this time, the rat should put on weight each week. After six months, the rat is killed. The specimen is fixed in formalin (solution of formaldehyd) 5 per cent, imbedded in celloidin after decalcification and then cut. Roentgenograms are used to determine the position of the apex in the tissues. Serial sections are prepared from the implanted apex together with the surrounding muscles. It is important to get the axis of the root canal in the plane of the section. The series should be as nearly complete as possible so that canal ramifications, if present, can be followed. The degree of, or absence of, inflammation round the root apex in the tissues of the rat constitutes the required control.

Further details may be obtained from the histologic laboratory of the Dental School of University Wien, IX. Türkenstrasse 15.

## NEWS

*New Medical Center Dedicated:* October 12, the entire Medical Center, New York City, was dedicated to its three-fold purpose of teaching, research and the care of the sick. During the six months preceding, a number of the hospitals associated in the Medical Center were moved and, during the month of September, Columbia University transferred to the Center four of its teaching groups: the College of Physicians and Surgeons, the School of Dental and Oral Surgery, DeLamar Institute of Public Health and the School of Oral Hygiene. The purely dental portion of the School of Dental and Oral Surgery occupies three floors superimposed on top of Vanderbilt Clinic, which is the outpatient department for the entire Medical Center. Many of the laboratories and class rooms of the College of Physicians and Surgeons are to be used by both medical and dental students, who will have much of their work in common. The dental classes have been limited to sixty, following the precedent established by the Medical School. The first class in dentistry registered at the Medical Center, September 28. The first six months of its functioning, the Medical Center devoted itself almost exclusively to the care of the sick, but with this new step its scope is considerably broadened. The units which are now functioning at the Medical Center are the College of Physicians and Surgeons of Columbia University, DeLamar Institute of Public Health of Columbia University, the School of Dental and Oral Surgery of Columbia University, the Presbyterian Hospital of New York, the Presbyterian Hospital School of Nursing, Squier Urological Clinic, Harkness Private Pavilion, and Sloane Hospital for Women and Vanderbilt Clinic. The Neurological Institute, the New York State Psychiatric Institute and Hospital and the Babies Hospital are to be open about the first of the year. The students of the dental school are allowed the general and clinical facilities of all of the hospitals and clinics of the Medical Center.

*Atlanta School of Oral Hygiene:* The Atlanta School of Oral Hygiene held its first session, Wednesday evening, October 3, in specially equipped quarters on the sixth floor of the Atlanta National Bank Building. This is a state chartered instiution, the first independent school in the South which teaches young women to become dental hygienists, and the only one in the United States which holds its lectures in the evenings, enabling its students to hold a position during the day. The school maintains an entrance educational qualification of a high school diploma. The time required for the work is nine months of training by lecture and clinical work. The first class opened with twenty young women, the capacity of the school. The institution has class rooms, and operating rooms, and also ample portable equipment, which is to be carried to charitable institutions, and schools for clinical work. The faculty consists of three dentists and three graduate dental hygienists: Drs. Robin Adair, Director, J. V. Pierson and Caldwell Holliday, Misses Addibel Forrester and Manilla B. Land, and Mrs. A. G. Smith.

# ANNOUNCEMENTS

## CALENDAR OF MEETINGS*

### NATIONAL SOCIETIES

American Dental Association, Washington, D. C., Oct. 7-11, 1929.

### STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June inclusive.

December (1928)

Ohio, at Toledo (4-6).

March (1929)

Minnesota, at St. Paul (6-8).

Montana, at Butte (28-30).

April (1929)

Alabama, at Birmingham (16-18).

Connecticut, at Waterbury (April 30-May 2).

Kansas, at Wichita (April 29-May 2).

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Kentucky, at Louisville (9-11).
New Jersey, at Asbury Park (10-13).
Texas, at Beaumont (16-19).
Virginia, at Danville (April 30-May 2).

May (1929)

Illinois, at Springfield (14-16).
Indiana, at Indianapolis (20-22).
Iowa, at Cedar Rapids (7-9).
Maryland, at Baltimore (6-8).
Massachusetts, at Boston (6-10).
Missouri, at St. Joseph (12-14).
Nebraska, at Omaha (20-23).
New York, at Rochester (15-17).
North Dakota, at Grand Forks (14-16).
Vermont, at Burlington (22-24).
West Virginia, at White Sulphur Springs (27-29).

June (1929)

Georgia, at Atlanta (12-14).
Maine, at South Poland (20-22).
Nevada, at Reno (1).

July (1929)

California, at San Francisco (8-12).
Colorado, at Colorado Springs (17-19).
Oregon, at San Francisco (8-12).
South Dakota, at Rapid City (1-2).
Utah, at San Francisco (8-12).
Washington, at San Francisco (8-12).
Wisconsin, at Milwaukee (9-11).

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Connecticut State Dental Association Midwinter Clinic, New Haven, Dec. 12, 1928.

Chicago Dental Society Midwinter Clinic, Jan. 14-16, 1929.

Dallas Midwinter Clinic, Feb. 11-13, 1929.

Dental Protective Association of the United States, Chicago, Ill., Dec. 17, 1928.

First District Dental Society of the State of New York, Dec. 3-6, 1928.

New York Society of Orthodontists, Dec. 12, 1928.

Southwestern Society of Orthodontists, Dallas, Texas, Jan. 2-5, 1929.

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## MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, Dec. 8, 1928. O. E. Jackson, Secretary, 1624 Franklin St., Oakland.

Delaware, at Wilmington, Jan. 16-17, 1929. W. S. P. Combs, Secretary, Middletown.

Iowa, at Iowa City, Dec. 10-13, 1928. State Department of Health, Capitol Bldg., Des Moines.

Kansas, at Wichita, first week in December. John L. Parkhurst, Secretary, Humboldt.

Minnesota, at Minneapolis, Jan. 11, 1929. F. E. Cobb, Secretary, 601 Donaldson Bldg., Minneapolis.

New Jersey, at Trenton, Dec. 3-8, 1928. Secretary, John C. Forsyth, 148 West State St., Trenton.

North Carolina, at Raleigh, Jan. 8, 1929. H. L. Keith, Secretary, 409 Murchison Bldg., Wilmington.

North Dakota, at Grand Forks, Jan. 8-11, 1929. Gilbert Moskau, Secretary, Grand Forks.

Oklahoma, at Oklahoma City, Jan. 7, 1929. Charles A. Hess, Secretary, Idabel.

Pennsylvania, at Philadelphia and Pittsburgh, Dec. 5-7, 1928. Secretary, Alexander D. Reynolds, 4630 Chester Ave., Philadelphia.

Rhode Island, at Providence, Dec. 11-13, 1928. Albert L. Midgley, Secretary, 1108 Union Trust Bldg., Providence.

South Dakota, at Sioux Falls, Jan. 7, 1929. Secretary, G. G. Campbell, Mitchell.

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## AMERICAN DENTAL ASSOCIATION

The Seventy-First Annual Session of the American Dental Association will be held in Washington, D. C., Oct. 7-11, 1929.

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## UNIVERSITY OF BUFFALO SCHOOL OF DENTISTRY ALUMNI ASSOCIATION

The twenty-ninth annual meeting of the University of Buffalo School of Dentistry Alumni Association will be held in Buffalo at the Hotel Statler, Wednesday-Friday, February 27-March 1.

L. J. GAUCHAT, *Chairman of Publicity.*

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## NORTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

The next regular meeting of the North Carolina State Board of Dental Examiners will be held in Raleigh, beginning promptly at 9 a. m., Monday, January 7. For further information and application blanks, address

H. L. KEITH, *Secretary,*
409 Murchison Bldg.,
Wilmington.

### DALLAS MIDWINTER DENTAL CLINIC

The Dallas Midwinter Dental Clinic will be held February 11-13. The clinicians are: T. W. Maves, Cleveland, Ohio, oral surgery; James W. Crawford, Milwaukee, Wis., prosthetics; Menifee R. Howard, Denver, Colo., surgery.

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### ALUMNI ASSOCIATION, COLLEGE OF DENTISTRY, UNIVERSITY OF SOUTHERN CALIFORNIA

The twenty-fourth annual meeting of the Alumni Association, College of Dentistry, University of Southern California, will be held, January 28-29, at the Clinic Building, Sixteenth and Los Angeles streets, Los Angeles.

GUY VAN BUSKIRK, *Editor,*
Union Bank Bldg.,
Los Angeles.

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### UNIVERSITY OF TORONTO ANNUAL COURSE FOR DENTAL PRACTITIONERS

The annual course for dental practitioners presented by the University of Toronto Faculty of Dentistry will be given in Toronto, December 17. A nominal fee is charged to cover the expenses of the course.

WALLACE SECCOMBE, *Dean.*

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### SOUTHWESTERN SOCIETY OF ORTHODONTISTS

The ninth annual session of the Southwestern Society of Orthodontists will be held in Dallas, January 2-5. A cordial invitation is extended to all ethical members of the dental medical professions to attend.

P. G. SPENCER, *Secretary,*
1817 Austin Ave.,
Waco, Texas.

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### DELAWARE STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Delaware Board of Dental Examiners will be held in the Municipal Building, Tenth and King streets, Wilmington, January 16-17, from 9 a. m. to 5 p. m.

W. S. P. COMBS, *Secretary,*
Middletown.

### NEW JERSEY STATE DENTAL SOCIETY

The 1929 annual meeting of the New Jersey State Dental Society will be held in the Berkeley-Carteret Hotel, Asbury Park, April 10-13.

F. K. HEAZELTON, *Secretary,*
223 E. Hanover St.,
Trenton.

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### SUPREME COUNCIL, ALPHA OMEGA FRATERNITY

The annual meeting of the Supreme Council of the Alpha Omega Fraternity will be held at the Copley Plaza Hotel, Boston, Mass., December 24-26. Address Leon Balicer, 2231 Washington St., Boston, for further information.

By order of
A. H. MENDELSOHN, *Supreme Chancellor,*
Medical Arts Bldg.,
Baltimore, Md.
A. M. FLASCHNER, *Supreme Scribe,*
419 Boylston St.,
Boston, Mass.

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### CONNECTICUT STATE DENTAL ASSOCIATION

The midwinter clinic of the Connecticut State Dental Association will be held at New Haven, Wednesday, December 12. The sixty-fifth annual meeting of the association will be held in Waterbury, April 30-May 2.

CHARLES F. EGAN, *Chairman,*
Publicity Committee.

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### BOARD OF DENTAL EXAMINERS OF CALIFORNIA

The Board of Dental Examiners of California will conduct an examination for a license to practice dentistry, in San Francisco, commencing December 8, at 8 a. m. The examination will be held at the Native Sons' Hall, 410 Mason St. Complete credentials, together with the required fee of $25 must be in the hands of the secretary at least twenty days prior to the examination. Only cashier's checks or money orders are accepted.

O. E. JACKSON, *Secretary,*
1624 Franklin St.,
Oakland, Calif.

## NEW YORK SOCIETY OF ORTHODONTISTS, MIDWINTER MEETING

The Midwinter Meeting of the New York Society of Orthodontists will be held December 12, at the Hotel Roosevelt, Madison Avenue and Forty-Fifth Street, New York City. All ethical members of the medical and dental professions are invited. The morning session opens promptly at 9:30. The usual luncheon will be served between the morning and afternoon sessions. Note the change of place of meeting.

WILLIAM C. FISHER, *Secretary*,
501 Fifth Avenue,
New York City.

## NEW JERSEY STATE DENTAL SOCIETY

The New Jersey State Dental Society will hold its fifty-ninth annual meeting at the Berkeley-Carteret Hotel, Asbury Park, April 10-13. Members of the American Dental Association and visiting dentists from other countries will receive a fraternal welcome. For information regarding exhibits, address H. J. Gibbins, 75 Roseville Ave., Newark, N. J.; clinics, K. C. Pruden, 44 Church St., Paterson, N. J.; literary program and general details, F. K. Heazelton, 223 East Hanover St., Trenton, N. J.

F. K. HEAZELTON, *Secretary*.

## STATE BOARD OF DENTAL EXAMINERS, STATE OF OKLAHOMA

The Oklahoma State Board of Dental Examiners will meet January 7, in Oklahoma City, at the Huckins Hotel, for the purpose of examining applicants.

CHARLES A. HESS, *Sec'y-Treas.*,
Idabel.

## TEXAS STATE DENTAL SOCIETY

The Texas State Dental Society will hold its forty-ninth annual convention at Beaumont, April 16-19. A cordial invitation to attend is extended to all ethical dentists who are members of state societies. For information relative to exhibits, address the chairman, John E. Storey, Goodhue Bldg., Beaumont.

J. G. FIFE, *Sec'y-Treas.*,
Medical Arts Bldg.,
Dallas.

## SOUTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the South Dakota State Board of Dental Examiners will be held in Sioux Falls, at the Carpenter Hotel beginning Monday, January 7.

G. G. CAMPBELL, *Secretary*,
Mitchell.

## NORTH DAKOTA STATE DENTAL ASSOCIATION

The next meeting of the North Dakota Dental Association will be held at Grand Forks, May 14-16.

L. I. GILBERT, *Secretary*,
Fargo.

## MINNESOTA STATE DENTAL ASSOCIATION

The forty-sixth annual meeting of the Minnesota State Dental Association will be held in the Auditorium at St. Paul, March 6-8. A cordial invitation to attend is extended to all members of the American Dental Association.

GEORGE D. ESTES, *Secretary*,
911 Yeates Bldg.,
Minneapolis.

## VIRGINIA STATE DENTAL ASSOCIATION

The annual meeting of the Virginia State Dental Association will be held in the Hotel Danville, Danville, April 30-May 2.

A. M. WASH, *Sec'y-Treas.*

## MARYLAND STATE DENTAL ASSOCIATION

The next annual meeting of the Maryland State Dental Association will be held May 6-8, at the Hotel Belvedere, Baltimore. Members of the American Dental Association from other states are cordially invited to attend the sessions of this meeting.

NORVAL H. MCDONALD, *Secretary*,
614 Medical Arts Bldg.,
Baltimore.

## CORRECTION

The Maine Dental Society will be held June 20-22, in South Poland instead of Portland, as announced in the Directory of State Society Officers, published in the November issue of THE JOURNAL.

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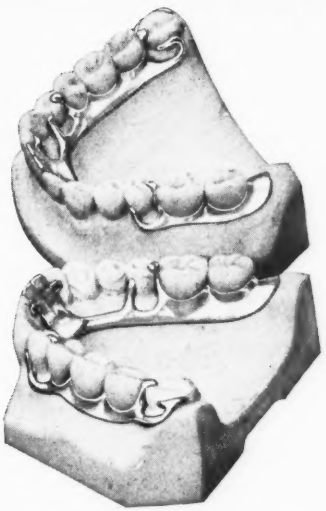

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